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THIRD EDITION.

THE ORGAN,

ITS HISTORY AND CONSTRUCTION:

A COMPREHENSIVE TREATISE

ON THE

STRUCTURE & CAPABILITIES OF THE ORGAN,

WITH

SPECIFICATIONS AND SUGGESTIVE DETAILS FOR INSTRUMENTS OF ALL SIZES

INTENDED AS A

HANDBOOK FOR THE ORGANIST AND THE AMATEUR.

BY

EDWARD J. HOPKINS,

Organist to the Honourable Societies of the Inner and Middle Temple.

PRECEDED BY AN ENTIRELY

NEW HISTORY OF THE ORGAN,

MEMOIRS OF THE MOST EMINENT BUILDERS OF THE SEVENTEENTH AND EIGHTEENTH CENTURIES, AND OTHER MATTERS OF RESEARCH IN CONNECTION WITH THE SUBJECT.

BY

EDWARD F. RIMBAULT, LL.D.,

Member of the Royal Academy of Music in Stockholm; Musical Examiner in the Royal College of Preceptors, London, &c., &c.

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PREFACE TO THE THIRD EDITION.

IN the present (third) Edition of "THE ORGAN: ITS HISTORY AND CONSTRUCTION," the entire work has been subjected to a thorough revision, and the contents of the Appendix have received many important additions and substitutions. Improvements in the mechanism of the Organ have continued to be made since the publication of the second edition of this work, which have been duly detailed as far as space would admit; and the same may be said with reference to the improvement in the general features of the specifications which have been issued and executed by some of the leading organ-building firms both in England and America.

All who enjoyed the personal acquaintance of the author of the Historical portion of this volume, the late Dr. Rimbault, will have felt the loss of so genial, accomplished, and unassuming a friend; but they will be glad to know that the revision of his portion of the present edition was completed some weeks before his active and useful life was brought to a close.

EDWARD J. HOPKINS.

23, ST. AUGUSTINE'S ROAD, N.W.,
June 1, 1877.

PREFACE TO THE SECOND EDITION.

THE arts of organ-building and organ-playing have made such rapid strides in England during the last few years that it was felt a new edition of "THE ORGAN: ITS HISTORY AND CONSTRUCTION," was urgently needed.

The practical portion of the work contains a full and minute description of the organ in every part of its manufacture. Not only has the material of the first edition undergone a complete and most careful revision, but two new chapters have been added; *i.e.*, those on Joy's *Hydraulic Blower* and the *Electric Organ. The Pneumatic Draw-stop Action* has been carefully described, and the chapter on the important question of *Temperament* has been entirely re-written.

In the preparation of the additional material, my friend, Mr. Hopkins, has been assisted in his labours by some of the most eminent organ-builders, both English and foreign; and through their co-operation correct and minute diagrams have been given, which will, it is confidently hoped, render the volume of the utmost possible practical use both to the organist and to the amateur. Special reference must here be made to the chapter and diagrams upon the most recent introduction, the *Electric Action.*

With regard to the "History of the Organ," I have bestowed some pains upon its revision and correction. Much curious and minute information has been added, the result of considerable

labour and research. The Treatise of *Hero of Alexandria*, with its interesting notice of the ancient Greek organ, has received attention; whilst the mediæval organ-builders and their works form an important and an entirely new chapter. The notices of the builders after the Restoration have received considerable and valuable additions, and the lists of their works have been carefully revised and extended.

For much curious and valuable information I am indebted to my friend, Mr. W. B. Gilbert, Mus. Bac., Oxon., late organist of Boston, Lincolnshire.

In the preparation of the "Specifications" (forming the APPENDIX), Mr. Hopkins has spared no time and labour. The descriptions and details given are the result, not only of much careful collating of the best authorities, but, in addition, a personal inspection of many of the most celebrated Continental instruments.

EDWARD F. RIMBAULT.

ST. MARK'S CRESCENT, REGENT'S PARK, N.W.,
Christmas, 1870.

PREFACE TO THE FIRST EDITION.

THE following work has been undertaken with the view of supplying what has hitherto been felt to be a great desideratum in this country; namely, a hand-book describing the construction of the English organ with the necessary minuteness to enable those not previously conversant with the subject to understand the formation, nature, and operation of every part of that most ingenious, complex, and noble of all musical instruments. In proceeding to carry out this design several plans presented themselves, but the one that appeared best calculated to place the subject in the most simple shape before the reader was that of arranging the various systems of mechanism and the several clever devices for giving speech and vitality to the organ into separate divisions, and then of describing the numerous parts which together form those main portions in the continuous order they are usually met with in modern English instruments. This course has therefore been adopted in the arrangement of the materials forming the following chapters; and each separate subject—as, for instance, some particular system of mechanism—is traced from its source to its termination, with a slight notice only (at the time) being taken of other portions of the intricate machine towards which it may occasionally approach closely, yet without having therewith any actual connection.

The endeavour has been made in the progress of the work to record the names of the originators of the numerous ameliorations

and improvements that have been made from time to time in the details of organ-building. This part of the design, however, has not been found by any means so easy of accomplishment as at first it might appear to be, for but few records were ever kept either of the date or the builder by whom such advantageous modifications were effected. An internal examination of numerous organs, and a comparison of their dates of construction have been made, with the view of arriving at a correct conclusion on all these points, and the result has been given; at the same time a date or fact may here or there have escaped the research of the writer, who will therefore be glad to receive any such testimony as may come under the notice of others, and which will be gratefully accepted and carefully preserved for future use. To account for the frequent appearance of names and dates in the descriptions of some of the more recent improvements, it may be mentioned that these have in all cases been given, where positively known, in the hope of obviating future uncertainty.

Among the most vexed questions of the present time regarding the English organ are those relating to the compass and the temperament of the instrument. To each of these subjects, therefore, a full chapter has been devoted, which, it is hoped, may have some influence in conducting them nearer towards a settlement. In these discussions, and indeed throughout the work, great pains have been taken to preserve as much simplicity of language and freedom from technicality as seemed practicable. Other matters of importance are those relating to the musical pitch, the composition of the compound stops, and the position of the organ, all of which have also been considered at some length.

The Appendix will be found to present a collection of specifications of British and foreign organs more varied in size and details, and more extensive in number, than has ever before been brought together in any similar work in any country. A few of

the English specimens are either accounts of instruments of past celebrity, or of such as were made according to a system now being fast superseded; but most of the Continental descriptions, it is confidently hoped, will prove of the highest value to organists in exemplifying what are the general principles observed by the foreign artists, to the investigation of which the organ-builders and organists of this country, fortunately, are now almost universally turning their attention. The accounts of foreign organs have partly been prepared from notes made by the writer and other tourists at the instruments themselves, and partly from previously printed accounts, the stops, however, being in all cases re-arranged and classified according to one uniform and simple plan, so that they may be more convenient for purposes of reference and comparison. The descriptions of British organs have been drawn up, in some cases, from accounts kindly furnished by their respective organists; in others, from well-known printed authorities; while the particulars of the more recently constructed instruments have been extracted chiefly from the descriptions issued by their respective builders.

It remains for the writer to tender his thanks to those gentlemen who have kindly favoured him with their suggestions and opinions; and he feels his acknowledgments to be particularly due to Mr. Hill and Mr. Walker, Mr. Robson and Mr. Jardine, for their exposition of certain technical matters; and to the Rev. Sir Frederick Gore-Ouseley, Bart., and to C. Harwood Clark, Esq., for placing their MS. note-books, containing accounts of numerous foreign organs, so entirely at his disposal.

EDWARD J. HOPKINS.

69, TACHBROOK STREET, PIMLICO,
June, 1855.

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AN HISTORICAL ACCOUNT

OF

THE ORGAN.

BY

EDWARD F. RIMBAULT, LL.D.,

&c., &c.

PREFACE TO THE FIRST EDITION.

WHEN I undertook to prefix to my friend Mr. Hopkins's valuable treatise on the construction of the organ an historical account of that noble instrument, my intention was to give a *résumé* of what had already been written, with the addition of such new particulars as the course of years had accumulated in my note-books; but, upon collating the various writers, their statements often appeared so vague and unsatisfactory that it became necessary to consider the subject more attentively, and in all cases, where it could be done, to consult *original* authorities. The result of this examination has been the clearing up of many doubtful points, and the discovery of some important particulars hitherto unknown.

All modern writers have been perplexed with the notices of the organ handed down to us by the ancient Greeks, and have endeavoured to reconcile them with our present ideas of the instrument. The *key-board* has been a constant source of difficulty, and the epigram, or rather enigma, of the Emperor Julian has been often cited to prove that it was known to the ancients. The discovery of a treatise on organ-building by a monk of the eleventh century (printed in the following pages) settles for ever this important question.

Another source of difficulty is the common expression, in mediæval times, of "a pair of organs." Some of our ablest antiquaries have exercised their erudition in endeavouring to explain

this term, but with what degree of success the reader who peruses the following pages will have an opportunity of judging.

At a later period in the History of the Organ the biographies of Smith and Harris have been involved in much obscurity. Father Smith has *fathered* all our *old* organs, of whatever kind or description; and so little attention has been paid to dates that we are told "Harris's most celebrated organs are those of St. Sepulchre's, London, 1667; and Doncaster, Yorkshire, 1738!" I have been enabled to arrange the various members of these two celebrated families under their respective periods, and by so doing have cleared away many anachronisms, and reconciled a few seeming impossibilities.

The Jordans and the Byfields, and their foreign cotemporaries, the Silbermanns, have also received the same attention; and, if the information regarding them is somewhat scant, it is all my research has been able to bring together.

The section on the "Ancient Position of the Organ" is interesting at the present time, when architects are anxiously looking for precedents. I have carefully noted all the authorities upon the point, especially in this country, which, added to Mr. Hopkins's able chapter on the "Situation of the Organ," will, it is hoped, be found of some practical utility. The rescue of this noble instrument from the "holes and corners" to which modern ecclesiologists have ofttimes assigned it is part of the musician's creed.

It will be observed that my historical account deals more with facts than with opinions. For the latter I am content to refer to the body of the book, trusting with full confidence to Mr. Hopkins's superior judgment and intimate acquaintance with his subject.

The History of the Organ, from the period at which I leave it, chiefly consists in a series of inventions, all of which receive their full share of attention from Mr. Hopkins in the course of the volume.

I ought not to pass unnoticed the aid I have received from several authors who have written upon the same subject. Amongst them I may especially name the Rev. Sir William Cope's paper on *Early Organ-builders in England*, inserted in the *Parish Choir;* Mr. Sutton's *Short Account of Organs built in England from the reign of King Charles the Second to the present time;* Herr Seidel's *Treatise on the Organ*, printed at Breslau; and M. Hamel's valuable reprint of "Dom Bedos," forming one of the publications of the *Encyclopédie-Roret.* If I have not named other modern works purporting to treat of the organ historically, it is because I have found them unworthy of credit.

It only remains to tender my obligations to those gentlemen who have kindly assisted me in the course of the following essay. I must especially thank my friend, F. W. Fairholt, Esq., F.S.A., for the valuable extracts from Mr. Rolfe's MSS., and for other information; William Chappell, Esq., F.S.A., for two or three curious notices; Mr. Hill, the eminent organ-builder, for the loan of G. P. England's Account Book; Alfred Price, Esq., of Gloucester, for his MS. translation of Herr Seidel's *Treatise on the Organ*, before mentioned; and lastly, Robert Hendrie, Esq., for his kindness in giving me permission to use his excellent translation of Theophilus's *Chapters on the Organ.*

EDWARD F. RIMBAULT.

29, ST. MARK'S CRESCENT, REGENT'S PARK,
June, 1855.

NOTES.

After paragraph No. 200, p. 49.—The following account and date of the first use of a "reversed key-board" will be read with interest. It has been kindly furnished to Mr. Hopkins by Mr. W. H. Cummings, who discovered it:—

"An organ made by Mr. Jordan, being the first of its kind, the contrivance of which is such that the master, when he plays, sits with his face to the audience (and the keys being but 3 feet high), sees the whole company, and would be very useful in churches. This organ has but one set of keys, but is so contrived that the Trumpet Bass and Trumpet Treble, the Sesquialtera and Cornet stops are put off and on by the feet, singly, or altogether, at the master's discretion, and as quick as thought, without taking the hand off the keys. The said Mr Jordan invites all masters, gentlemen and ladies, to come and hear this performance at his workhouse, against St. George's Church, Southwark, and will give his attendance from 2 till 4 o'clock, all next week, Ash Wednesday only excepted. N.B.—This organ was played on and approved by several masters in public, the latter end of November, and is fit for any small church or chappel."—Advertisement in the *London Journal*, Saturday, Feb. 7, 1729—30.

After paragraph No. 266, p. 68.—Among other motors for blowing organs, gas engines have been introduced. These start at full power at a moment's notice; and common gas is said to feed the engine at one penny an hour per horse power.

After paragraph No. 307, p. 87.—The "pneumatic tubular transmission system" remains here to be noticed. This recent improvement promises to supersede the ordinary tracker "long-movement" for the distant departments of all large organs. The germ of this application is found in the late Mr. Booth's contrivance already referred to on p. 59, consisting of a tube receiving compressed wind at one end and having a "motor" at the other; but it was not until the year 1867 that the principle was turned to the present admirable account, when it was applied to an organ publicly shown at the Paris Exhibition in that year. The tube-pneumatic was first introduced to the English public by Mr. Henry Willis, in his recent re-build of the organ in St. Paul's Cathedral. It is also extensively used by the same builder in his Great organ in the Alexandra Palace; by Messrs. Bryceson, in the organ removed by them from St. Paul's to the Victoria Rooms, Bristol; by the Messrs. Bishop, in the Yarmouth organ as recently re-built by them; and by Mr. Lewis, for the Pedal organ of his new instrument in Ripon Cathedral.

After paragraph No. 559, p. 133.—Among the future improvements of the organ the introduction of string stops promises to be one of considerable importance. For some years experiments have been carried on to perfect an arrangement by which the vibrations of a reed are communicated direct to a string, and the sound produced is that of the string. This has been the subject of a series of patents. The plan is in so forward a state that a small separate instrument, called the "wind-viol," has been successfully tried, producing sounds of organ-like power, but with the true string tone. A series of apparatus to illustrate the invention was exhibited in the Loan Collection of Scientific Apparatus at South Kensington,

the description of which occupies two pages of the official catalogue (pages 170 and 171, 2nd edition). The last patent shows the invention as applied to a separate instrument, by superseding the bow by the use of wind governed by the keys of an ordinary Manual, so that with a string for each note a complete stop is formed, and it is perfectly understood that the production of new and original stops for the organ is the ultimate object of Mr. J. B. Hamilton and the other patentees, and that the great value of the patent lies in that direction. The patentees at present appear only desirous to complete their invention and secure their rights.

After paragraph No. 1165, p. 282.—The most convenient height for the surface of the organ-stool above the pedals is twenty inches.

INDEX TO CONSTRUCTION OF THE ORGAN.

T.

PART III.

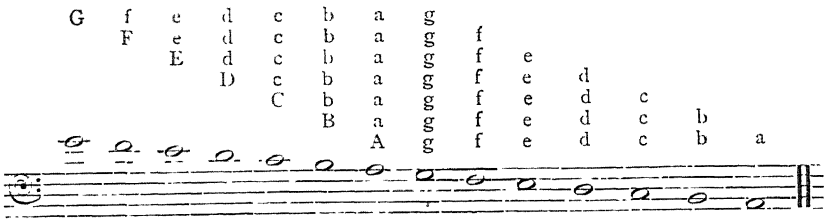
CHAPTER XXVI.

THE TUNING AND TEMPERAMENT OF THE ORGAN.*

723. FROM very early times the interval of the perfect octave has, by philosophers and musicians, been divided into 53 equal parts, called *commas;* and the successive sounds of the diatonic scale have, by the aid of these commas, been shown to be separated by intervals of the following "sizes" or comparative dimensions :—

	Major tone.		Minor tone.		Semitone.		Major tone.		Minor tone.		Major tone.		Semitone	
I.		II.		III.		IV.		V.		VI.		VII.		VIII.
C	9	D	8	E	5	F	9	G	8	A	9	B	5	C
0		9		17		22		31		39		48		53

724. The foregoing are the sizes of the several intervals as deduced from Nature's suggestions; and it is quite probable that the organ was, at a very early period, tuned in recognition of this system of "perfect attunement." The extremely simple nature of the early church music; the non-existence of harmony; and the peculiar construction of the ancient *octo-chords* or *modes*—produced by taking, in succession, each different sound of the old diatonic gamut as the initial note, and proceeding thence to its octave, thus :—



did not call for or suggest any departure from it; and an organ having scarcely two octaves of perfectly attuned diatonic sounds must have been equal to all the musical requirements of the time.

725. But when the idea occurred of *transposing* some of the ancient chants, to bring them within the compass of a less extended range of voice—the higher into a lower pitch to suit bass voices, and the lower into a higher to suit tenor voices—and the gradual introduction of the five chromatic semitones to facilitate this among other ends:—then the preservation of the primitive method of attunement could no longer have been possible. Take, for an example, the natural major diatonic scale of C. That could not be transposed into G, because the tones between G and A and A and B were each of the wrong "dimension"

* Only an outline of what might be said on this subject is given in the present chapter. Its fuller treatment is reserved for separate publication.

for the purpose; nor could D be taken as a key-note, inasmuch as the interval between that sound and E was a *minor* tone only.

I.		II.		III.		IV.		I.		II.
G	8	A	9	B	5	C		D	8	E.

726. Such misuse of the distinctive tones would have produced a "wolf" in all the scales except the primary one, as unequal temperament afterwards did in all the keys beyond A major and B flat major.

The union of perfect attunement with the power of transposition impossible.

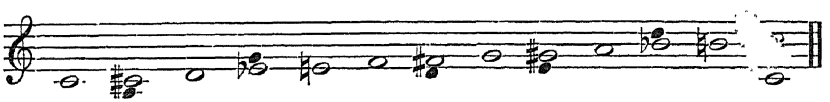
727. For a long time the question as to the attuning of the scale, so as satisfactorily to adapt it to the gradually increasing requirements, was, to quote the words of an old writer, "found to be an unmanageable thing." Nor was the division of the octave into a given number of intervals of the *exact dimension* suggested by nature at all practicable. The number *twelve*—that of the semitones in the octave—is divisible into 6 twos, 4 threes, or 3 fours, representing the whole tone, the minor third, and the major third respectively. But 6 major tones, of 9 commas each, would amount to 54 commas; 4 minor thirds, of 14 commas each, to 56 commas; while 3 major thirds, of 17 commas each, would only amount to 52 commas; 53 commas being the number that represented the perfect octave. There would therefore have been an excess, or shortcoming, as the case might be, had the octave been divided according to any of the smaller "exact" intervals.

The susceptibility of certain intervals being tempered discovered.

728. At length it was observed that certain intervals would bear being tuned a little in excess of, or short of, perfect, without offending the ear. This discovery led to the introduction of a system of *tempering*,* in which the thirds and fourths were tuned rather sharp, and the fifths rather flat. The result of this tuning was the *distribution* of the "three commas" by which the major tones exceeded the minor, and a slight augmentation of the minor tones, so that the five tones in the diatonic series were rendered equal in dimension.

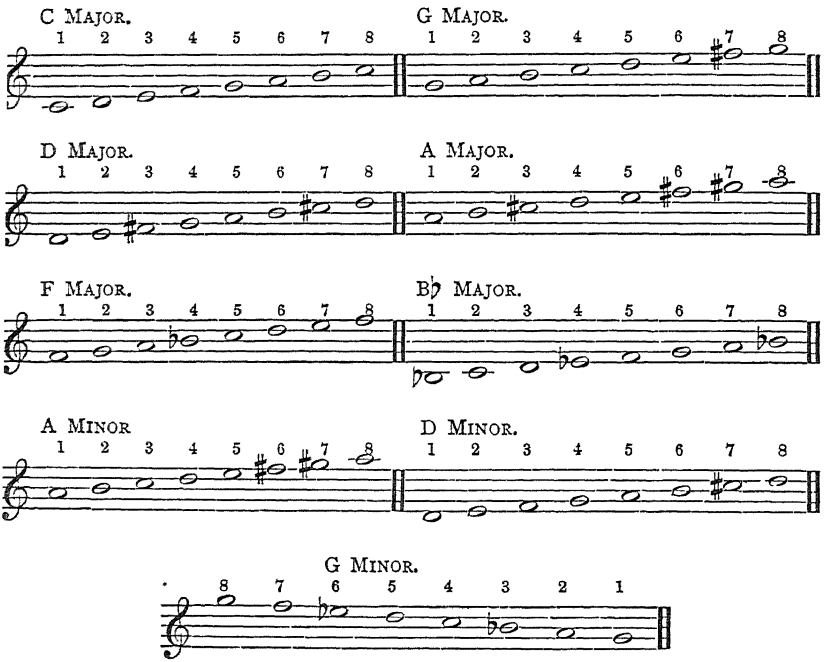
Unequal temperament, and the practicable scales it introduced.

729. The first modern who urged the necessity of a temperament was Bartholomew Ramis, a Spaniard, who wrote before the year 1482. By the date just named all the five short keys had been added to the seven different diatonic sounds of the key-board. Of these five three were tuned as the first three sharps, namely, F, C, and G; and two as the first two flats, namely, B and E. The short keys were, further, tuned as pure thirds, or nearly so, to the long keys represented by the black notes in the following example :—



* In all instruments having the usual number of keys to the octave the natural inequalities between the tones and semitones are softened down and hidden, as far as possible, by *distribution:* and any sound that is slightly raised or lowered in receiving its

This step was a great one in advance in the cause of *practical* music. It brought into existence, on keyed instruments having thirteen sounds and twelve intervals in the octave, *six* practicable major scales—C, G, D, A, F, and B flat—in place of the one perfect one; and *three* minor scales, instead of one, viz., A, D, and G.



Bontempi, writing in the seventeenth century, and reviewing the progress that music had made during the two centuries that had elapsed between the era of the establishment of the unequal temperament and his own time, could not refrain from describing that method of tuning as "that sublime and memorable operation which so improved the noble science of counterpoint."

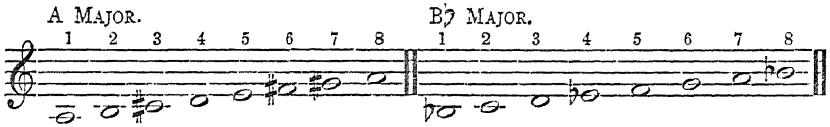
The introduction of unequal temperament strongly opposed, but nevertheless established.

730. The greatest opposition was, nevertheless, offered to the system by the purists of the time; and an animated controversy ensued, which continued to rage with great violence for more than a century, between the adherents to ancient proportions, on the one hand, and the friends of tempered scales, on the other. The contest, however, ended in favour of practical progress.

731. At first, little more than half the number of the available scales were made use of. Those almost exclusively employed were C, G, D, and F major, A and D minor, and a few of the ancient modes more or less modified. Nor did the music of the fifteenth century present much modulation; for, in whatever key a piece of music commenced, in that key it remained almost rigorously throughout. For such want of constructive variety and contrast—as it would now be considered—some compensation was, however, afforded by the more nearly accurate intonation of the few progressions of melody and harmony that *were* used; for us the agreeable relief arising from a change of scale was a resource almost unknown,

the earlier tuning had not been required to be much modified to provide for it. The altered tuning, on the other hand, admitted of greater freedom in writing, of which composers gradually learnt to avail themselves.

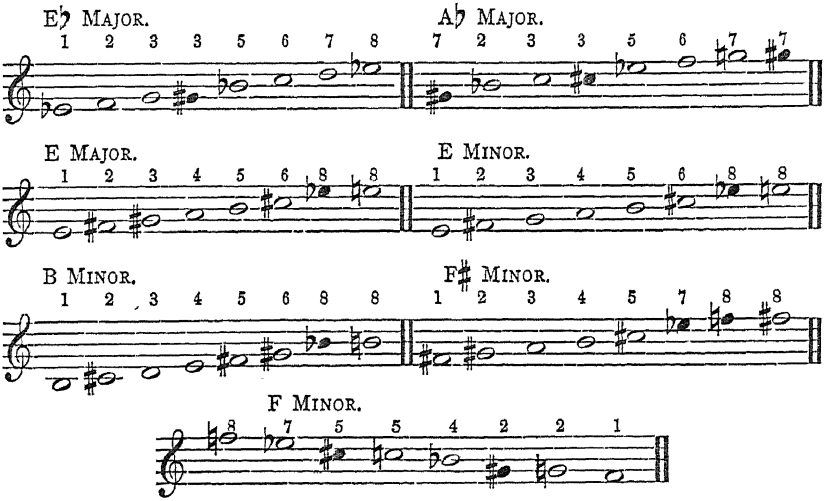
732. In this way the remaining practicable scales, namely, A and B flat major,



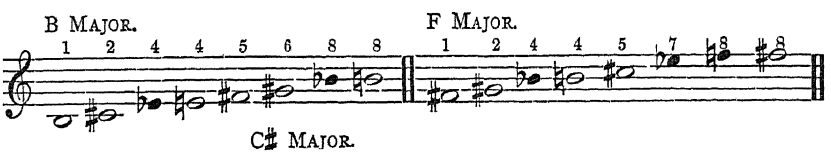
were, by degrees, taken into requisition; and, as those two scales employed all the five short keys of the clavier, they necessarily marked the farthest limits as to range of scales established or allowed by the unequal temperament.

The musical art progressing required other scales beyond those provided by unequal temperament.

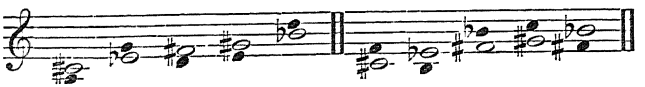
733. The art of musical composition continued to progress; and as "form" began to take the place of the rather fragmentary style of writing that had previously and of necessity prevailed, and as the "attendant keys" of the *boundary* scales were first touched, then dwelt upon, the use of other scales was required that had not been provided by the framers of the prevailing temperament, and which had not, in fact, any practicable existence on keyed instruments as then tuned. Some of those were E flat major, A flat major, E major, E minor, B minor, F sharp minor, and F minor.



After a time other scales, again, came to be required, among which were the following:—



Music written in either of the foregoing ten scales, on being played on an unequally tempered organ, could not fail to produce an effect very offensive to sensitive ears; and a little investigation would reveal that the main cause of the untunefulness arose from the fact that each of the five short keys was tuned *either* as the *sharp* to the long key to the *left*, or as the *flat* to the long key to the *right*; but in no case so as to serve in the two capacities, thus :—

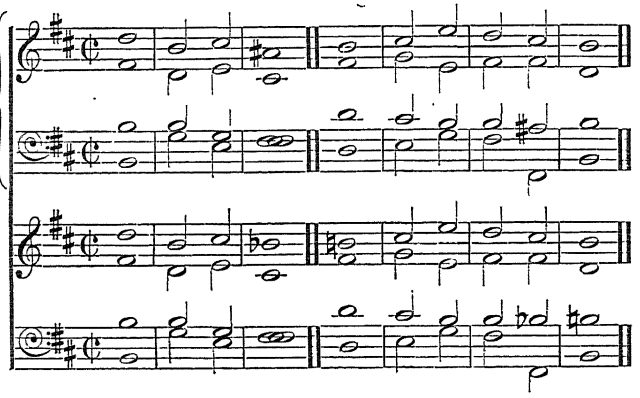


The unequal tuning left the scale of E flat without a proper fourth (A flat); and the scale of A flat not only had no suitable tonic, by reason of the omission of that same A flat, but it was also without any proper fourth (D flat). The scale of E major had no leading note (D sharp); and B had neither a proper third (D sharp) nor a seventh (A sharp—see preceding examples). And so on with the other scales. The consequence of such tuning may be best shown to English readers by extracts from works well known in England, which are accordingly subjoined; or it may be *heard* if they be played on an unequally tempered organ.

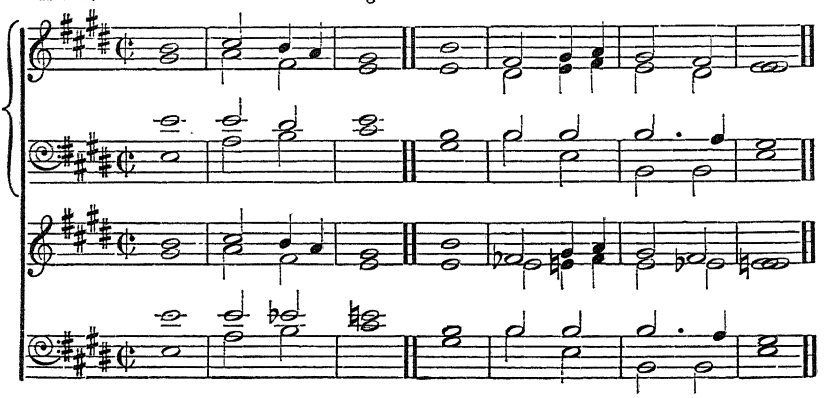
EX. 1. *Single Chant.* DUPUIS.

As written.

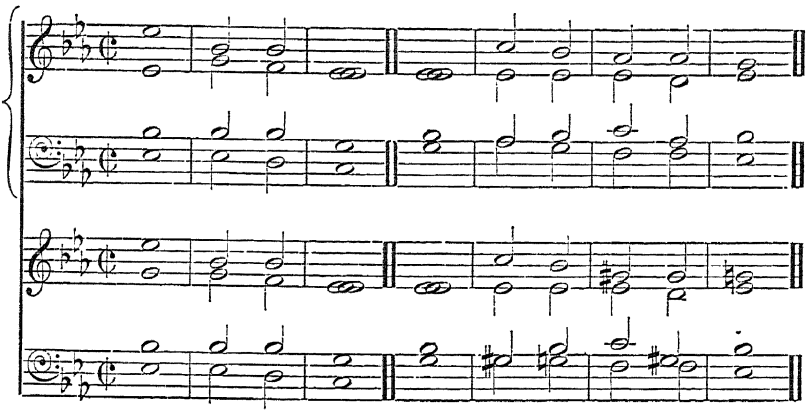
As sounded on an unequally tempered Organ.



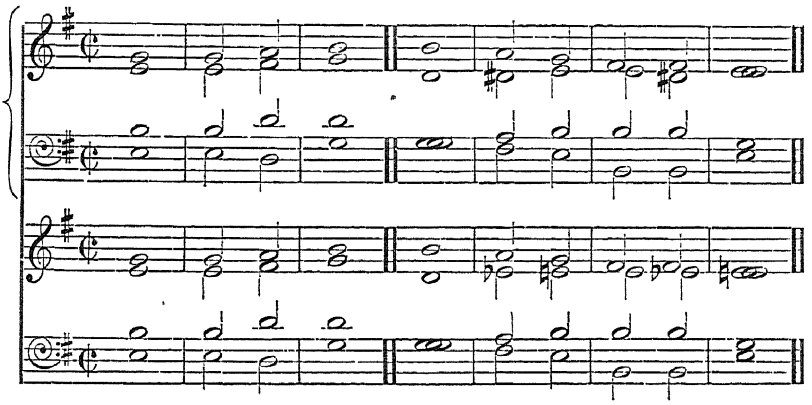
EX. 2. *Single Chant.* HAYES.



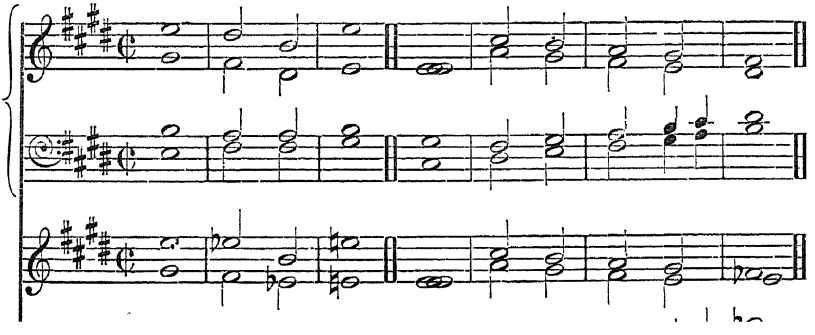
Ex. 3. *Single Chant.* BATTISHILL.

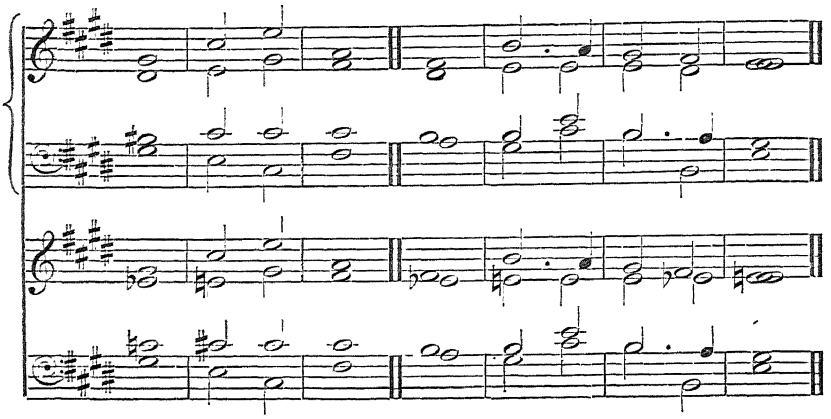


Ex. 4. *Single Chant.* DR. BLOW.

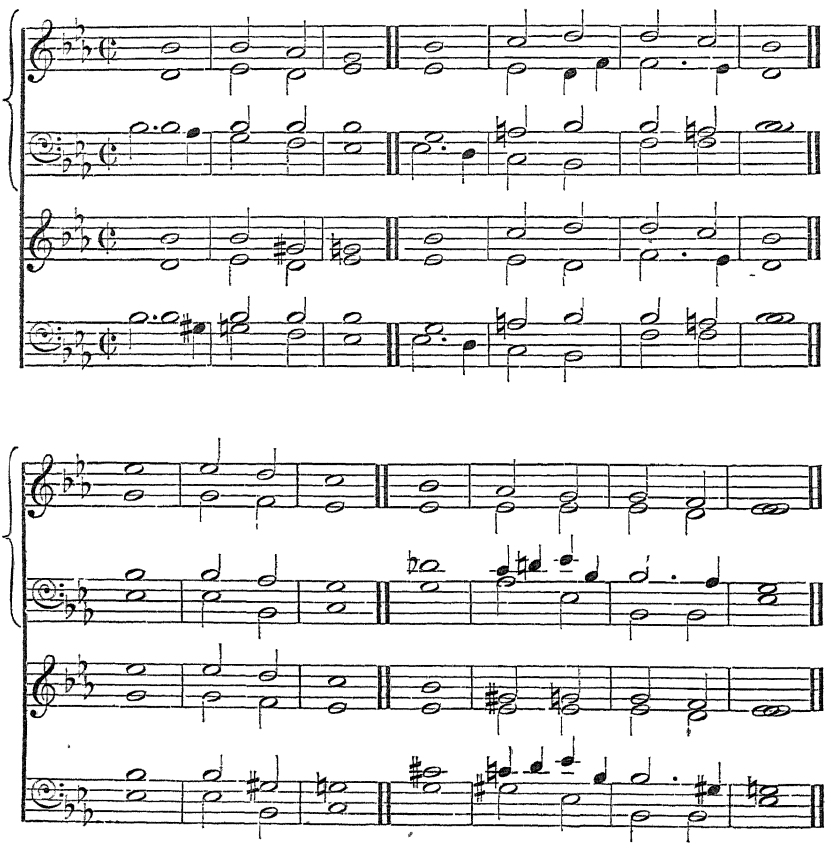


Ex. 5. *Double Chant.* DAVY.

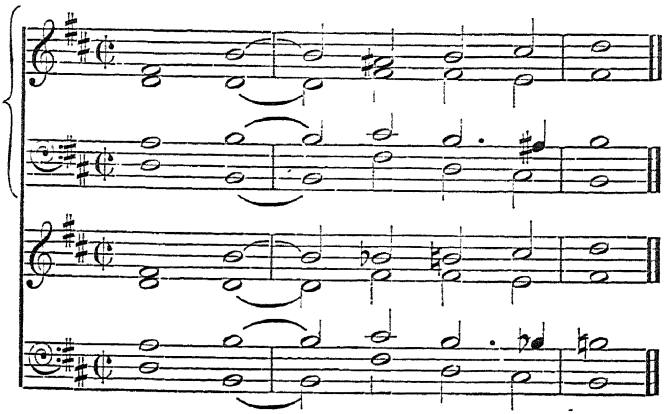




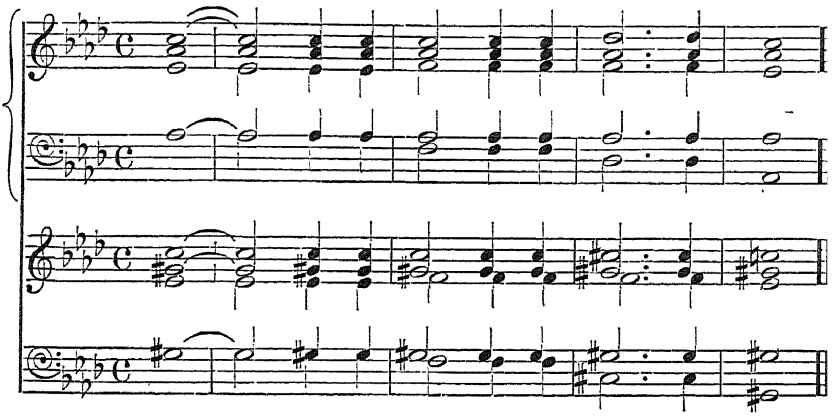
Ex. 6. *Double Chant.* LORD MORNINGTON.



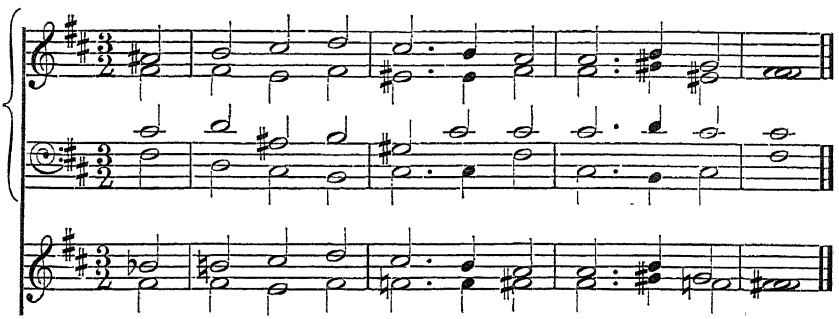
Ex. 7. *Behold! now praise the Lord.* ROGERS.



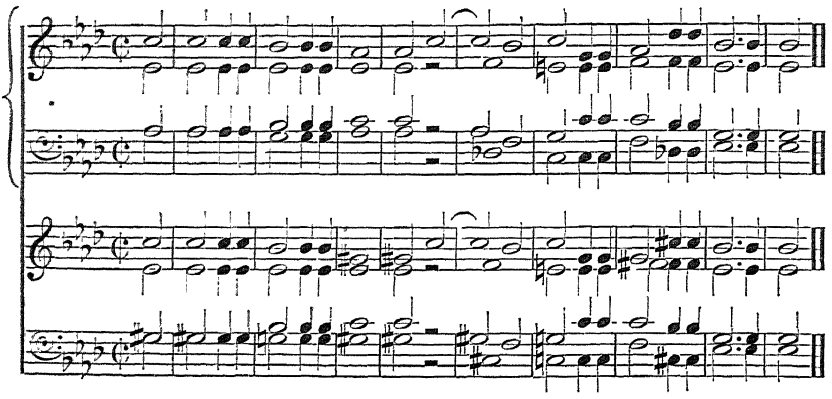
Ex. 8. *O where shall wisdom.* BOYCE.



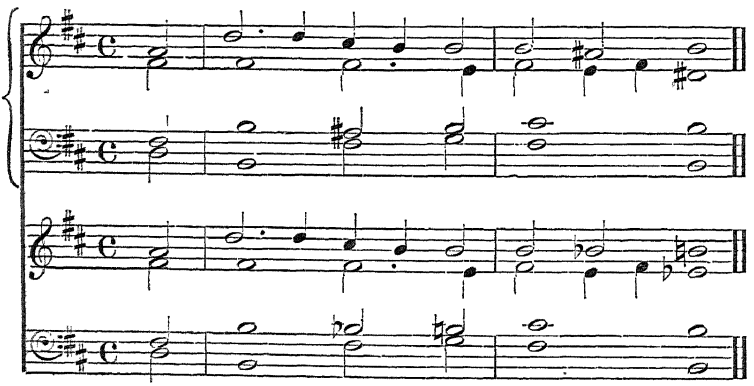
Ex. 9. *I will love Thee.* CLARK.



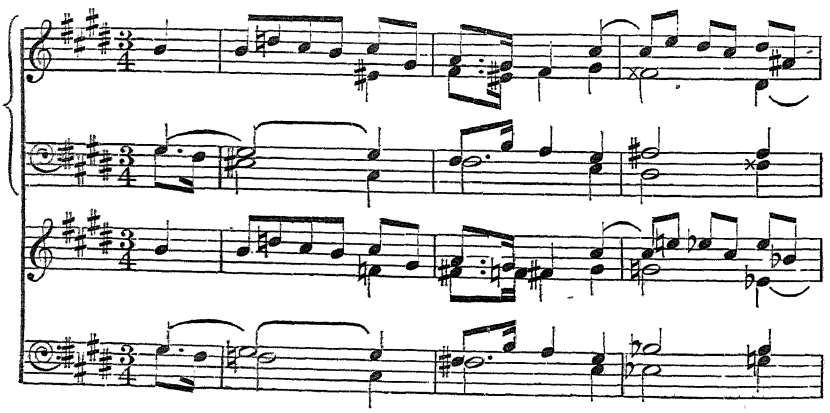
Ex. 10. *By the waters of Babylon.* Boyce.

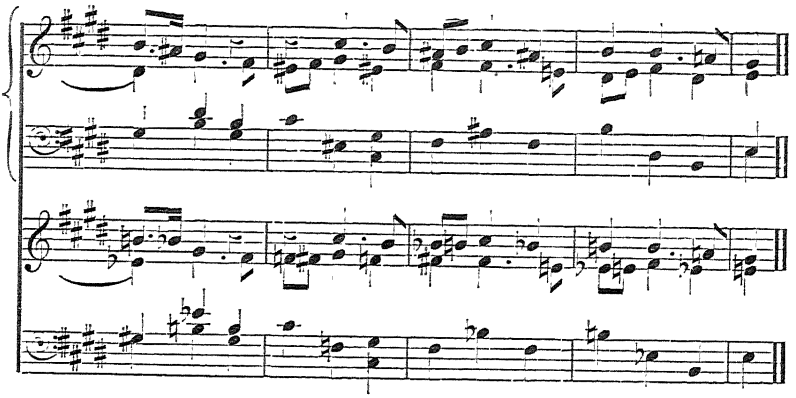


Ex. 11. *The Father everlasting.* Rogers, in D.

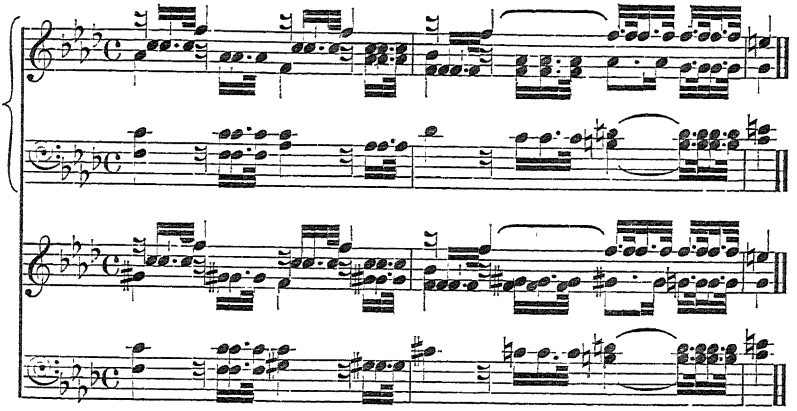


Ex. 12. *Turn Thee unto me.* Boyce.

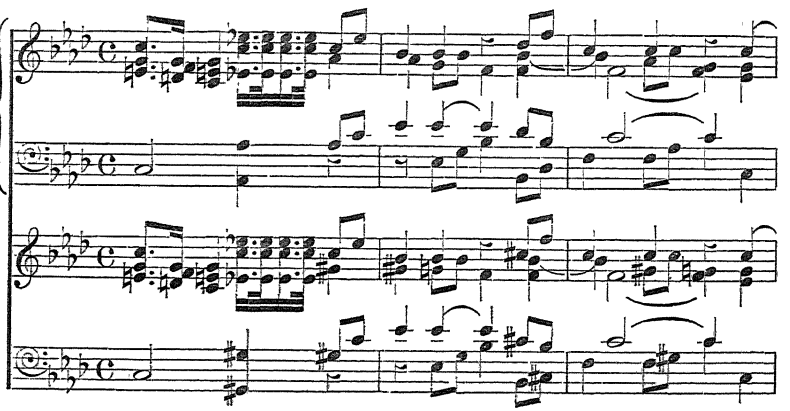


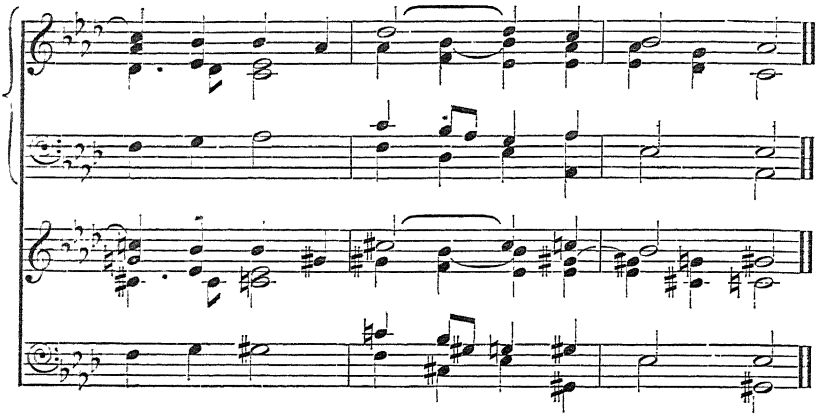


Ex. 13. *Surely He hath borne our griefs.* HANDEL.

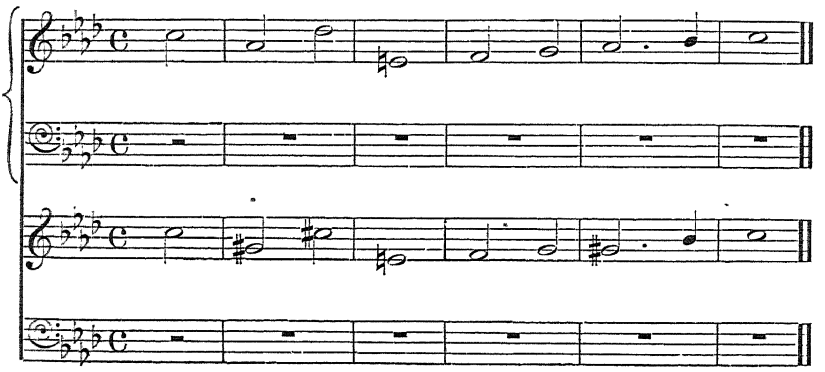


Ex. 14. *Surely He hath borne our griefs.* HANDEL.

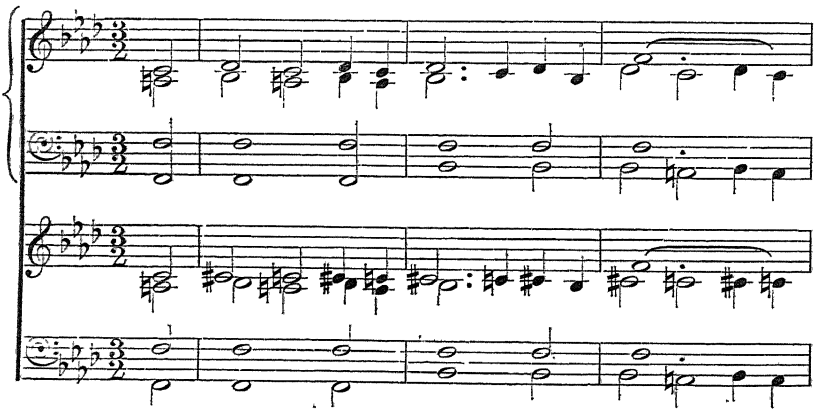


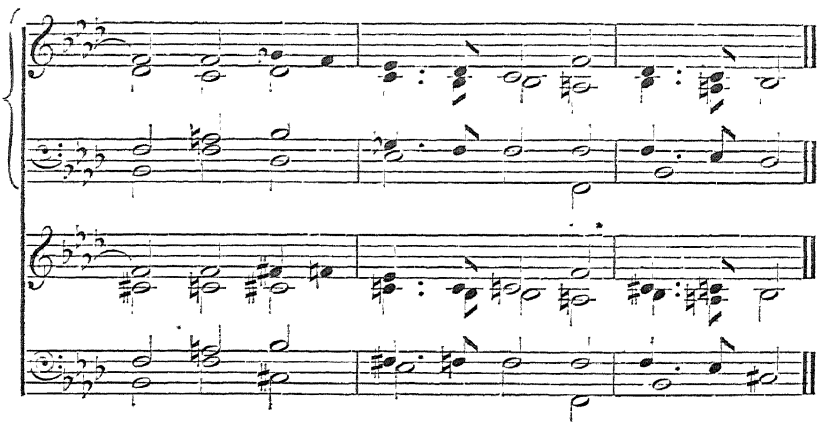


Ex. 15. *And with His stripes.* HANDEL.

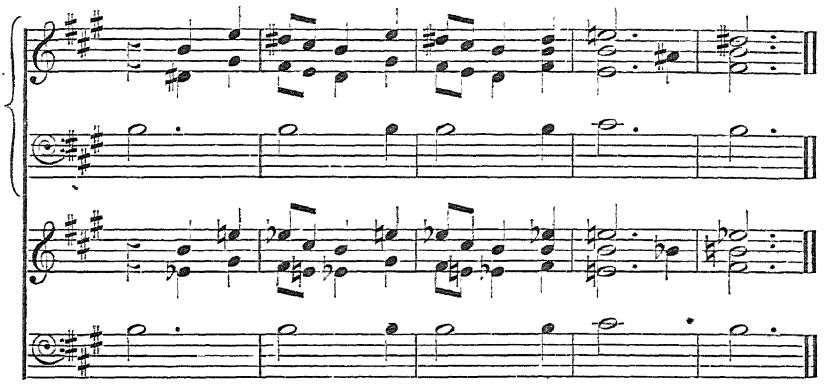


Ex. 16. *O Lord God of my salvation.* DR. CROFT.





EX. 17. *And all flesh shall see it together.* HANDEL.

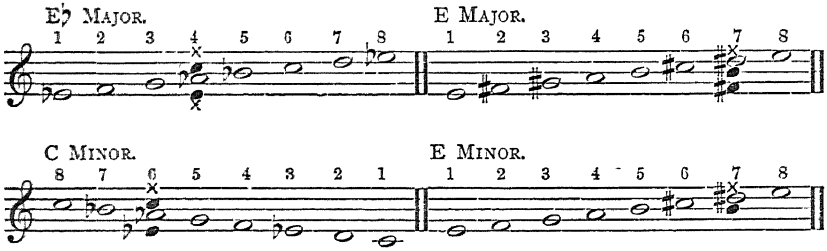


734. The foregoing musical extracts, although but few in number, are sufficient to show that the system of unequal temperament, which had so admirably facilitated the progress of music up to a certain extent, had, in the course of time, become "insufficient" for the greatly increased and still increasing requirements. The musical art had been undergoing *continuous* and *rapid development* during the two centuries that had elapsed between the time of the introduction of that temperament and the beginning of the eighteenth century, while the system of tuning *had remained stationary*. Thus the resources presented by the latter, which were, at the time of its establishment, not only sufficient for, but far in advance of, the current musical necessities, had not only passed into common use, but many others had come to be much required. Indeed, if investigated by the clearer vision of increased musical intelligence, the result could only have been the discovery that an organ, tuned according to the then prevailing system, was, in one sense, *an extremely incomplete enharmonic organ.* It was an instrument that, on the one hand, presented C sharp as distinguished from D flat, E flat as distinguished from D sharp, and so on ; yet, on the other, presented but half the major diatonic scales in a practicable form, only one quarter of the number of the minor scales, and no

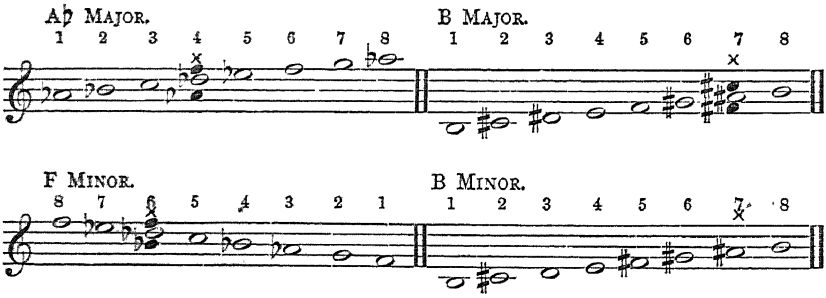
chromatic scale, the distances of the fixed sounds being neither what nature nor art required for the last-mentioned purpose.

The defects of the unequal tuning known in the sixteenth century.

735. Nor was the detection of these inherent defects in the then existing organ scale a discovery only of the eighteenth century. So far back as the *middle of the sixteenth century* several organs existed in Italy having two extra keys in each octave, inserted for the purpose of hiding some of the asperities of the unequal scales. Salinus, in his treatise, *De Musica*, published in 1577, relates that many organs in his time had what in England have since been denominated *quarter-tones*, one between A natural and G sharp (A flat), and a second between D natural and E flat (D sharp). On many such organs he had often played, particularly on a very famous one at Florence, in the monastery of the Dominicans, called Santa Maria Novella. Rather more than a century afterwards, that is, in 1685, the same two extra notes were introduced into the Temple organ by Father Smith,* namely, the third flat (A flat) and the fourth sharp (D sharp), which brought into a musical and available form two more major and two more minor scales, namely, E flat major, C minor, and E minor.

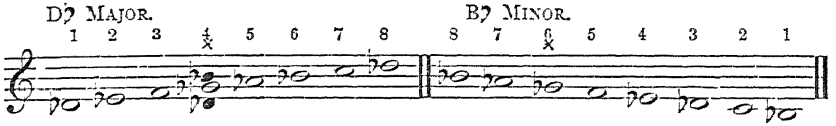


Further ameliorations of a similar kind were subsequently made in England. For instance, the organ of the chapel of the Foundling Hospital, erected in 1759, had two more quarter-tones, namely, the fourth flat (D flat) and the fifth sharp (A sharp). These, again, moulded two more major and two more minor scales into a musical form, A flat major, B major, F minor, and B minor.



* An old MS. book, preserved in the Library of the Honorary Society of the Inner Temple, thus notices these additions:—"The organ at the Temple hath quarter notes, which no organ in England hath, and can play any tune; as, for instance, ye tune of ye 119 Psalm (which was set in E minor), and severall other services set by excellent musicians, *which no other organ will do.*"

736. About the year 1808 Hawkes took out a patent for an organ which, in addition to the foregoing, presented the fifth flat (G flat). This rendered one more major and one more minor scale practicable, D flat major and B flat minor.



The scales up to five sharps and up to five flats inclusive were thus made available. The remaining four sharps and flats, two of each, were not, however, represented.

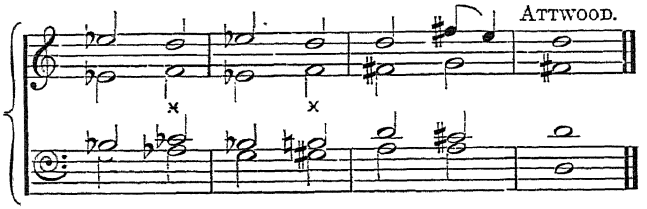
Enharmonic organs.

737. Nearly a quarter of a century before the date just given the elder Russell had made an organ with twenty sounds in the octave, among which were doubtless included all the foregoing. At subsequent periods other organs were built with a still greater number of sounds in the octave, until those erected for the late Rev. Mr. Liston and Colonel Thompson, which had forty-three and forty sounds in the octave respectively. Nor were instruments of this nature so modern an invention as some might imagine. Vincentino, in the middle of the sixteenth century, invented an instrument of the harpsichord kind, to illustrate the three ancient genera, which had such an accumulation of wires to represent the great variety of intervals, that the instrument had to be furnished with six rows of keys ; and a modern organ specimen has three elaborate key-boards for the manipulation of a single stop, and *then* only incompletely illustrates the theory it is intended to elucidate.

Perfect attunement.

738. Such instruments presented several varieties of every degree in the musical scale, as C, D, E, tuned a comma sharper or flatter than others ; so that the distinction between the major and the minor tones, &c., of every separate scale could be rigorously produced. They not only answered their purpose well, but served theoretically to illustrate the exact difference between a multiplicity of sounds, which, from the force of habit, some might be apt to consider identical. Their general adoption, however, could not follow, for many reasons, such as the enormous cost of the extra pipes ;* the great additional room necessary to accommodate them ; the complex machinery or key-boards that would be required to bring them into active use, &c.

739. Moreover, in proportion as *theoretical perfection* was approached, as to intonation, by the introduction of additional sounds, the *practical disadvantages* were *increased;* for it destroyed the ambiguity in certain harmonic combinations, which is one of the greatest and richest resources of the musician's art. The beauty of an enharmonic modulation consists, as all musicians know, in "the theoretical change *without* the practical difference."



* An enharmonic organ, with one stop and three manuals to play it with, costs about £300.

A simple practicable Manual scale required.

740. The great question that had to be solved was not whether it were possible to make an instrument that, whatever its merits, could not pass into general use—for that had already been demonstrated conclusively more than once—but whether it were practicable, *without* increasing the number of twelve sounds in the octave, so to tune or "temper" those that they would *practically* meet the then increased and all future possible musical requirements. It was in Germany, and in the early part of the last century, that this important theme was first started and discussed; and the glory of its elucidation in the affirmative was chiefly due to the genius of the great John Sebastian Bach, who produced and advocated the system of tuning now so generally known as that of "equal temperament."

Equal temperament

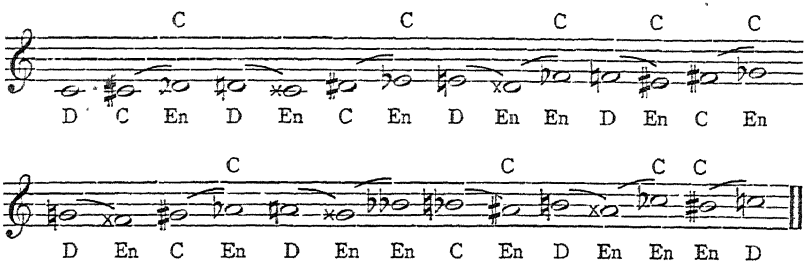
741. This wonderful yet simple system consists in dividing the octave into twelve semitones by fixed sounds, as uniform in dimension to the *ear* as are the inch marks of the foot-rule to the *eye*. The results of that tuning are as follows:—Firstly, every one of the twelve different sounds can be made the key-note from which a well constituted and equally useful *diatonic* scale can follow; and which diatonic scale, further, may be either in the major or the minor form. Thus the *twenty-four* major and minor scales are at once rendered available, and equally so for melodic or harmonic progressions. Secondly, any one of the twelve different sounds can be taken as the commencing note of an even and uniform chromatic scale. Thirdly, the numerous beautiful enharmonic transitions and modulations can be realised in the manner intended by the great composers who originated them, without the destructive distinctions which would result if the *altered notation* were accompanied by an *altered intonation* that, despite its theoretical propriety, in practice is *not* wanted.

742. From what has been said it will be seen that every note is, according to this system, designed to serve in "different capacities;" some in several. For example, the sound representing C may be either a key-note or a natural diatonic second, third, fourth, &c., to another key-note, or it may be treated as B sharp or D double flat, or it may be changed, *upon paper*, from C natural to B sharp, as by an enharmonic change. Every one of the other eleven sounds is designed to serve in a similar manner. In a word, this wonderfully constituted *compound* scale comprises the twelve major and twelve minor scales and the chromatic and the enharmonic scales *all in one*.

743. Nor did Bach simply "theorise" respecting his scale. His writing, teaching, and playing were in consonance with his artistic conviction. In the year 1722 he produced the first book of his well known 48 Preludes and Fugues, under the title of "The Well-tempered Clavier, or Preludes and Fugues through all the tones and semitones concerning the major third, or *C, D, E*, as well as touching the minor third, or *D, E, F*. For the use and study of young eager musical students; as also for the leisure hours of those who are already advanced. Composed and revised by John Sebastian Bach," &c.* In the year 1744 he issued a second set of the same number of Preludes and Fugues, and again in the 24 different major and

* "Das wohl temperirte Clavier oder Præludia und Fugen durch alle Tone und Semitonia sowohl tertiam majorem oder *Ut, Re, Mi*, anlangend, als auch tertiam minorem oder *Re, Mi, Fa*, betreffend. Zum Nutzen und Gebrauch der Lehrhegierigen Musicalischen Jugend, als auch derer in diesem studio schon babil seyenden besondern Zeit Vertreib aufgesetzet und verfertiget von Johann Sebastian Bach, *p. t.* Hochfürstl. Anhalt. Cöthenischen Capell-Meistern und Directore dorer Cammer Musignen. Anno 1722."

minor keys. In these works Bach made use of the following members of his "compound" scale. (The diatonic and chromatic notes are distinguished by their initial letters D, C, and such of the enharmonic as are included are marked by *En* and a bind.)



In his "Chromatic Fantasia" Bach put upon paper many notes, which, differing in appearance, and being also unlike in theory, were yet intended to be the same in sound.

744. Nor did he leave his opinion as to the necessity for a compound diatonic, chromatic, enharmonic scale for the organ less indelibly stamped upon the works he wrote expressly for that instrument. In those works he allowed himself the utmost freedom in the choice of "initial" keys; also as to the other keys into which he passed, as well as the most unfettered use of chromatic progressions and enharmonic modulations whenever he required their introduction.

The part Bach took in the establishment of equal temperament.

745. In the biographies of Bach, by Forkel and Hilgenfeldt, occur several passages that describe the condition in which Bach found clavichord playing and tuning, what he did to develop the capabilities of that instrument, and how he effected that end. Hilgenfeldt says: "At the end of the seventeenth century it was *not* customary to play in *all* the keys. Those with *more* than *three* sharps or flats were seldom used. The reason of this was, undoubtedly, the 'unequal' mode of tuning the instrument, which was obstinately adhered to in preference to the system now known as 'equal temperament.'" Forkel writes to the same effect: "Before his (Bach's) time, and in his younger years, it was usual to play *not* in all the twenty-four modes. The clavichord could not be perfectly tuned; people played therefore only in those modes which *could* be tuned with the most purity. Bach *extended* the use of the modes, partly by deviating from the ancient modes of church music, and partly by mixing the *diatonic* and *chromatic* scales. He learnt (or discovered how) to tune his instrument, so that it *could* be played upon in all the twenty-four modes. Bach tuned both his harpsichord and his clavichord *himself;* and he was so practised in the operation that it never cost him above a quarter of an hour. But *then,* when he played from his fancy, *all the twenty-four modes were in his power;* he did with them whatever he pleased. He combined the *most remote* as easily and naturally together as the *nearest;* the hearer believed he had only modulated within the compass of a single mode. He knew nothing of harshness in modulations; his transitions in the chromatic scale were as soft and flowing as if he had wholly confined himself to the diatonic scale. His 'Chromatic Fantasia,' which is now published, may prove what I here state. *All his extempore* VOLUNTARIES *are said to have been of the same description, but frequently* MUCH MORE FREE, *brilliant, and expressive.*"

Equal temperament opposed, as unequal tuning had been before it.

746. The equal temperament system, nevertheless, met with the greatest opposition, as the unequal method had before it. While it was admitted that equal temperament moulded into practicable form fifteen scales that were non-existent on an unequally tempered organ, it was objected that it also left the first nine scales in not so good a condition as they were before. This was, in substance, a repetition of the argument that had held good for centuries against unequal temperament; which latter, while it rendered seven scales practicable that were not so before, left the first two that previously were pure no longer in that condition. It was a line of reasoning that told against all temperament whatever, and could be applied until the perfect attunement of many centuries before were restored, and with it the comparatively primitive state of the art of musical composition; or—the improved state of the latter partially preserved—enharmonic organs became general, and with them their theoretical beauties, practical imperfections, complexity of manipulation, and impossible pedipulation. Such a position, in fact, was assumed not many years ago by a writer whose advocacy of just intonation forbade his admitting any merit in any temperament whatever. Bontempi, in his *History of Music*, page 188, 1695, spoke of temperament as a "divine thing," while the writer just alluded to described it in the same words without the adjective, namely, as "a *thing!*"

747. One of the strongest opponents to the adaptation of equal tuning to the organ is said to have been Silbermann, the celebrated organ-builder; and the tradition runs that whenever Sebastian Bach observed Silbermann among his select circle of auditors he used to say to him, in perfect good humour, "You *tune* the organ in the manner *you* please, and I *play* the organ in the key *I* please;" and thereupon used to strike off a fantasia in A flat major, the contest invariably ending in Silbermann's retiring to avoid the "howling of his own wolf."

748. Equal temperament was opposed also on the ground that it destroyed the "distinctive character of key" which unequal temperament imparted to the different scales. A slight acquaintance with unequal temperament would disclose, as shown on pages 162 and 163, that a few of the commonest scales were by it rendered nearly, if not quite *alike*, by reason of the removal of the difference between the major and minor tones; consequently, but little distinction of "character" existed among them, but rather was to be found among the remaining fifteen scales, some of which are shown on page 163. And it appeared among the latter in consequence of the dissonance produced, in greater or less quantity, by the unavoidable use of the wrong *dieses*, or quarter-tones, as indicated by the black notes. All those scales contained at least one instance, and some two, of the same degree of the scale occurring *twice over*; some other degree, or degrees, being omitted altogether. This is shown by the *figures*, as well as notes, in the foregoing examples. Those wrong fixed sounds brought into those scales intervals as whole tones that were, in dimension, *greater* than the *major* tones of perfect attunement—the REDUCTION of which was one of the grounds on which unequal temperament was originally devised—and other intervals as semitones that were considerably too small and dissonant for the purpose. Yet for those scales the exaggerated or contorted intervals of which were not in the least degree produced by design, but appeared, both as to number and situation, just where accident had chanced to throw them during the process of tempering the first nine scales—for those scales a merit and advantage was claimed on the plea that they established a variety of "character" that was useful and desirable to the musical art! Scheibler* spoke much to the purpose when he said: "Such a

* *An Essay on the Theory and Practice of Tuning*, by Scheibler, page 26. Cocks and Co.

*E flat major . } Full and mellow; sombre, soft, and beautiful. It is a key in which all musicians delight. Though less decided in its character than some of the others, the regularity of its beauty renders it a universal favourite. (Bach's St. Ann's Fugue is written in this key; also, Mendelssohn's chorus, 'Thanks be to God.')

*C minor. . . } Complaining; having something of the whining cast of B minor. (Bach's *Passacaglia* and several of his most beautiful fugues are written in this key.)

*E major. . . Bright and pellucid; adapted to brilliant subjects. In this key Haydn has written his most elegant thoughts. Handel mistook its properties when he used it in the chorus, 'The many rend the skies with loud applause.' Though higher than D, it is less loud, as it stretches the voice beyond its natural powers.

It is sufficient to have hinted at these effects. To account for them is difficult; but every musician is sensible of their existence."

751. Enough is set forth in the above quotation, after allowing something for over-colouring, to show the immeasurable superiority of equal temperament over the unequal on the question of "character of key" under consideration; not the least of its greater excellencies consisting in its transforming the otherwise "wolfish key" of A flat major into "the most lovely of the tribe."

Temperament, as the only source of distinction of key, questioned.

752. It is doubtful, however, whether the question of "character of key" should ever have been *so much* mixed up with that of "temperament" as it has been, since writers are by no means unanimous as to the precise source from which springs that distinction.

Pitch supposed to exercise an influence in establishing the character of key

753. In unequally tempered instruments a distinct character of key undoubtedly exists; but it is of so untuneful a nature that, instead of proving an *advantage*, it is a source of pain to sensitive ears. To cite one further example: Dr. Burney, in his *Musical History*, vol. iii., page 608, says of the work from which Ex. 16, on page 170, is taken: "The anthem for three voices, from the eighty-eighth Psalm, is truly pathetic and expressive, from beginning to the end; but, unluckily, the key in which it is composed (F minor) is so much out of tune on the organ, as it is usually tempered, that the effect must be doubly offensive to those who, though possessed of good ears, are unable to account for it." Equal temperament removes the cause of this crude distinction. But in doing so, it must, in the opinion of some, destroy all difference between one key and another. Clear as this conclusion seems to be, experience shows that on an equally tempered instrument a distinction of key nevertheless *does* exist. The equality of the tuning can be proved *mathematically*; yet a difference in the keys is perceived *practically*, and reason has hitherto failed to fathom this subtile phenomenon. Some have attempted to account for it by supposing that an *unintentional* temperament must find admittance; that the tuner, unconsciously, has perhaps a bias in favour of certain keys. Others would attribute the distinction to the influence of a second and independent agency, namely, *pitch*, or the grave and acute qualities of sound. As to the manner in which that influence is exercised, they propose to account for it by supposing that, when an author composes a piece of music, he first determines his

key, and then confines his ideas to the proper compass of the voices or instruments for which he is writing. Thus, in penning a vocal piece for a treble voice of average compass, if c^2 be taken as the key note, the available range would be half an octave upwards, and a whole octave downwards; if f^1, it would be a whole octave upwards, and half an octave downwards; if a^1 flat, it would be a sixth upwards, and a sixth downwards, and so on; and that each separate melodial range has perforce its own distinct series of attendant harmonies. That *students* and *auditors*, by performing and hearing music so written, are thus gradually led to ascribe to each of the keys a specific character. In this case, however, the primary influences would appear to be the limits of the voice, and other circumstances under which the music was written, rather than any inherent and peculiar property in the *pitch*. If any specific quality ever belonged to certain sounds—of which sounds the musical scales are formed—that quality would continue to exist; therefore, on *an alteration of pitch* taking place, such as has actually occurred, by ascent, to the extent of a semitone, since the time of Haydn, the scales that formerly had sharps for the signature, though now having flats, would still be brilliant; and those which had flats, though now having sharps, would be the reverse. Music written in the last century, in the "golden, warm, and sunny" scale of A major, would now be heard in the "least interesting key" of B flat major, and so on; whereas no such perversion of sentiment has ever been declared to have taken place.

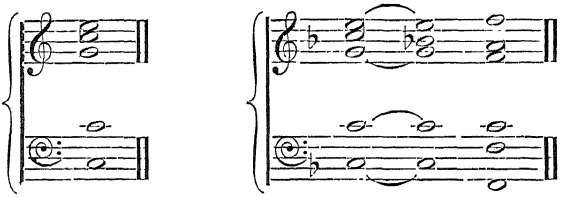
The internal resources of the musical art capable of giving any character to any key.

754. The probability is that neither *temperament* nor *pitch* have so much to do with giving "greater power of colouring to the musical art," by means of the establishment of the so-called "character of scale," as the *internal resources of the art itself*. For since music has become a *language*, as well as a *science* and *art*, composers have been enabled to express *whatever they please* in any *scale* they please. They have drawn music of a given "character," *and its opposite*, from one and the same scale. Thus, if Handel selected the "bold, vigorous, and commanding" scale of C major for "The horse and his rider" chorus, he employed it with equal success also for his "Dead March" in *Saul*. If Mendelssohn adopted the same scale, "expressive of war and enterprise," for his "Military Duet," he used it no less felicitously for his sweet and peaceful aria, "O rest in the Lord." If he fixed upon the scale of G minor, "replete with melancholy," for his most pathetic second movement in the instrumental introduction to the *Lobgesang*, he adopted the same "meek and pensive scale" with equally perfect success also for two of his most vivacious *scherzos*, those in the *Otteto* and the *Midsummer Night's Dream* music. Weber selected the "awfully dark and tragic" scale of D flat major for his inspiriting "Invitation to the Dance." But to whatever circumstance, or combination of circumstances, the distinction of scale is observable, all musicians are sensible of its existence.

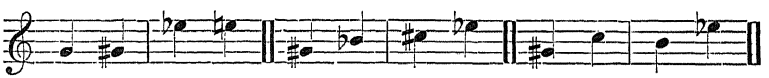
Characteristics of equal temperament.

755. We have *heard* how "out of tune" the unequal tuning makes some of the scales that are even in constant use; and we have *seen* the cause. We have also noticed in what way equal temperament removes that cause, namely, by, among other things, tempering the sound of all the short keys, so that they will serve either as the *flat* to the white key *to the right*, or as the *sharp* to the white key *to the left*. Its influence in the enharmonic scales, which is considerable, is not here dwelt upon. The equal temperament, by rendering each of the twelve fixed sounds susceptible of answering two or three distinct purposes, possesses advantages, as well as a degree of practical simplicity and efficiency, quite peculiar to itself.

756. In distributing the wolf equally among all the scales, the major thirds in a few of the more common keys are made rather sharper than in the unequal temperament. This, the most grave objection taken to the equal system of tuning, never amounts to a striking defect, while, under certain circumstances, it becomes a positive beauty. It is well known that the most perfect organ and instruments in existence, the human voice and the violin, can produce all the gradations of the enharmonic scale; yet both singers and performers on string instruments *prefer* making the leading note *not* a perfect third to its root, but *sharp*. And as every major triad, at the same time that it forms the *tonic* triad of one scale (c for instance), also forms the *dominant* of the *fifth below*, f;



it follows that its third, e, as the leading note of that dominant harmony, accords more closely with the custom observed by the best practical musicians, from the very circumstance of its being sharper than perfect. Besides this, the sharp thirds infuse a freshness and spirit into the common keys, which, according to the old temperament, they do not possess. Besides this, the equal temperament much improves the effect of the whole series of minor scales; in which, it will be recollected, a very considerable proportion of the English church music is written. Again, as nearly all well-cultivated voices have been tutored at an equally tempered pianoforte, a similarly tempered organ must prove the best accompaniment to them. No singer would think of sounding for semitones such intervals as those which occur on an unequally tempered organ between G natural and G sharp, or between E flat and E natural; or such as those between G sharp and B flat, or between C sharp and E flat for whole tones; or such as those between G sharp and C, or between B and E flat for major thirds :—



In this respect, singers have frequently been censured for "singing out of tune," when the fault has rested solely with the barbarous temperament of the organ by which they have been accompanied.

757. Then, in practice, the equal temperament is the only system that affords unfettered facility for the transposition of a piece of music (when that may be required), without distorting the intervals of its melody, or rendering the progress of its harmony crude and exaggerated. In this variable climate it frequently happens that, by transposing a psalm tune or a chant a semitone or a whole tone lower, the voices of a choir or congregation may be spared much exertion and unnecessary fatigue. Besides this, organs vary more or less in pitch; and, if an instrument be tuned very high, the music can then be transposed without harshness being imparted to it. In the *Harmonicon* for 1824, a correspondent states that "till of late years the organ in St. Paul's Cathedral was half a note above the usual standard, and the organ part of the music performed at the Feast of the

Sons of the Clergy was therefore obliged to be transposed half a note lower than the other parts for the accommodation of the organist."

758. As to the manner in which tempered sounds are received by the musical sense, Mr. G. A. Macfarren has explained this matter very clearly in his *Lectures on Harmony*, published by Longman and Co., Paternoster Row. On pages 43 and 44 he says :—"The system, I believe, first practised by Sebastian Bach—which has now become general—of tuning keyed instruments by equal temperament, consists in prevaricating the enharmonic diesis—that is, the distinction between D sharp and E flat, &c.—by tuning notes too sharp for the one and too flat for the other of their names, and by making a like compromise between the still minuter discrepancies of the diatonic scale, so that, while no interval is perfectly true, the ear is in neither case shocked by false intonations. It is, however, a beautiful and a wonderful property of the musical sense, so to adjust these tempered notes, that in every key they produce the same effect upon us in relation to other notes that the perfectly attuned notes would produce which they represent." And on page 141 he further adds that, "in despite of equal temperament, the ear has the admirable facility of so adjusting the tempered sounds which enter it, that they seem to us not what we hear, but what we should hear, were all the notes perfectly attuned to the true natural scale." At the same time, another fact cannot be concealed, which is, that it is quite possible for the ear, under the influence of a firm imagination, to be encouraged to refuse to receive tempered sounds when presented in a particular shape—or even in any shape whatever—and yet tolerate the far more egregious effect of the use of the wrong diesis. The painful effect, however, of such unequal tuning on sensitive ears may be gathered from the following :—The late Adolph Hesse was in England in the year of the first Great Exhibition, together with his father-in-law, Louis Spohr. Both were at Westminster Abbey on the occasion of the Purcell Festival, and, after service, Hesse was asked to try the organ—then *unequal* —which he proceeded to do. He had not played many chords before he discovered the condition of the tuning ; when, directing Spohr's attention to it, he positively declined to touch another note, and, with Spohr, closing his ears, left the organ gallery. On his return to Germany, Hesse had occasion to write "something about English organs," in which he said, in reference to the unequal tuning: "It is inconceivable to me how, in the neighbourhood of the best orchestral music, and of the most splendid and perfectly well-tuned pianos, the ear can reconcile itself to such barbarisms."

759. One of the earliest and most earnest advocates, in England, for the application of equal temperament to the organ was the late Dr. Crotch—himself a very great authority—who directed attention to the subject, on the last page of the second edition of his *Elements of Musical Composition*, in the following words :— "The author cannot but regret that the preference of English organists for the old method of tuning has been (as he is informed) hitherto so strong and determined, as to have resisted and repelled the attempts made to introduce the equal temperament into our cathedrals and churches. He has for many years uniformly recommended that this system should have a fair trial, upon the principle that, as all tempered fifths and thirds offend the ear, those systems which contain such as are most tempered and most discordant cannot be preferable, especially in an age when the keys which have four sharps and three flats can no longer be excluded from general use. It has at length been fairly tried, and, having carefully examined it, he feels convinced that its practicability and superiority are as unequivocal on the organ as they are allowed to be on the pianoforte, and on all other instruments which contain only twelve different notes on each octave. He continues to press

these opinions, not merely because they are his own, but because, in so doing, he is contending for the far higher authority of the judgment and practice of one whom, he trusts, his opponents must venerate and admire—the greatest of all composers for his sacred instrument—

SEBASTIAN BACH."

Mr. George Hogarth, in an article on the organ, printed in the *Musical World* for 1836, page 21, observes :—"The organ in England is tuned according to a system of temperament different from that which prevails on the Continent, and the effect of which is that the harmony is intolerably impure in all keys which require more than three sharps or three flats." And the late Chevalier Neukomm, in the preface to his *Organ Voluntaries*, inquired—"Why do the English organists continue to follow a barbarous system no longer adequate to the improved state of modern instrumental music, and which renders the organ unfit for accompaniment when in concert with other instruments?" Mr. Hullah, again, in his *History of Modern Music*,* page 9, observes :—"The modern European system, though the exigencies of practice prevent its being absolutely true, is nearer the truth than any other system ; and its inaccuracies are so slight as to cause little disturbance to the most refined ear. I mean by this that all our music is, of necessity, a little out of tune ; for our intervals vary, *however slightly*, from those deduced from the division of a musical string into aliquot parts. But the discrepancy, I repeat, is so slight, and distributed, by the system of *equal temperament*, over so many instances, that it is practically of no consequence." To these several observations it may be added that the preference of English organists is *not* now for the "barbarous system," but has become almost as universally "strong and determined" *in favour* of J. Sebastian Bach's tuning. A few of the instruments thus tempered may here be enumerated. St. Paul's Cathedral (both organs) ; Westminster Abbey ; St. Sepulchre's, Snow Hill ; Temple Church ; All Saints', Margaret Street ; St. Andrew's, Wells Street ; Foundling Hospital ; Crystal Palace (both organs) ; all the Town Hall organs in the Kingdom, &c., &c. Equal temperament is *universally* adopted on the Continent.

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* Longman and Co., Paternoster Row.

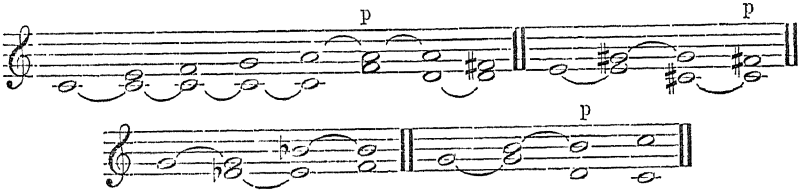
CHAPTER XXVII.

THE TUNING OF THE ORGAN.

Laying the bearings, and extending their influence to the stops generally.

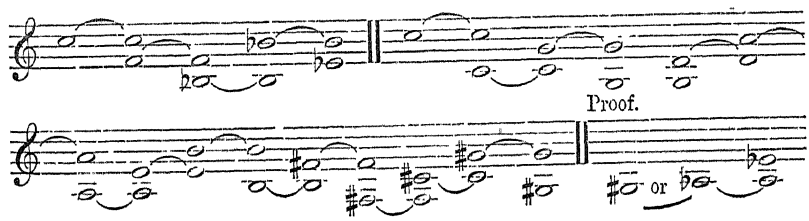
760. If the sounds of a set of pipes, or a stop, are to be adjusted according to "perfect attunement," the thirds, fifths, &c., will of course be tuned mathematically true; but if so as to present some kind of *tempered* scale, then the first step taken is to "lay the bearings." This process, after adjusting the starting sound to the pitch of the tuning-fork, consists in tuning the remaining eleven sounds of the octave by intervals of a third, fourth, fifth, sixth, or octave, up or down, as the case may be, and at the same time of making those intervals, except the octave, which is always tuned absolutely perfect, "bear" nearer towards or farther from the sounds from which they are being calculated than if they were being tuned justly.

761. The following scheme exhibits one of the most approved methods of laying the bearings on the unequal temperament principle :—



The bound note is in each case supposed to be tuned; the other is the one to be adjusted. In laying the bearings, all the thirds, fourths, and sixths that are tuned upwards are made a little sharp, and those that are tuned downwards rather flat. The fifths, on the contrary, are tuned a slight degree flat upwards and sharp downwards. As the tuner proceeds with his work, he occasionally tries the temperament of a note just tuned with some other note previously adjusted, to ascertain whether the bearings are being laid correctly. These references are called *trials* or *proofs*, and are made by adding the major third, fourth, or sixth, above or below, to the note just tuned. If the intervals upwards prove to be rather greater than perfect in all cases, except between c sharp and f sharp, which should be rather flat, all is right; but if otherwise, then some of the previous bearings are not quite correct. The proofs are, in the above scheme, indicated by the initial letter p.

762. In laying the bearings according to the equal temperament system, the tuning is frequently proceeded with by fifths and octaves only, as shown in the following example :—



763. The bearings are laid in and about the middle octave and a half of the stop, as will be perceived on referring to the notation of the two last examples; and the stop usually selected for the purpose is the Principal, the pitch of that stop being the medium one between the unison and small stops. The bearings having been laid, the remainder of the stop is tuned in octaves to the pipes already adjusted. After this, the unison flue stops are tuned, and then the smaller stops, the reeds being left till last. The fifth and third-sounding stops, as also the fifth and third-sounding ranks of the Compound stops, are tuned in absolutely perfect thirds and fifths to the Foundation stops.

How the pitch of the several kinds of organ pipe is altered

764. *A large open metal flue pipe* has its pitch raised by cutting away a ring of the metal from off the top of the pipe, and is lowered by soldering a ring on. Or the pipe is furnished with a sliding cap or cylinder, which is slipped up or down, according to whether the pitch of the pipe is to be lowered or raised. Sometimes a large pipe is tuned by a slit made in its back at the upper end. This is particularly the case with front pipes. By bending the two edges apart, so as to leave an aperture, the pitch of the pipe is sharpened, and by closing them it is flattened. Sometimes all the pipes, except the small ones, are left rather long, and a "tongue" of metal cut near to the top, which is inclined inwards or outwards, according as the pitch of the pipe requires flattening or sharpening.

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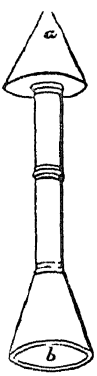

765. *A small open metal flue pipe* is tuned by an instrument constructed for the purpose, conical in shape, called a *tuning-horn*. Tuning-horns are of many different sizes, all of which come into requisition in the course of "tuning an organ through." The larger ones consist simply of a hollow cone (*fig.* 118), made of brass; the smaller, of a handle (*fig.* 119) with a solid metal cone at one end (*a*) and a hollow cone at the other (*b*). Through the instrumentality of a tuning-horn, the top of a pipe may be slightly contracted or expanded, *i.e.*, its edge may be drawn in or turned out as occasion may require.

766. All the flue pipes in an organ are first "cut down" as nearly as possible to the exact pitch. If any pipe is still a slight degree too flat, the pointed end of the cone is pressed into the aperture at the top of that pipe, which turns the edge a little outwards, and so slightly raises its pitch. If, on the contrary, a pipe is a little too sharp, the hollow part of the cone is forced over the top of that pipe, which draws its edge inwards, and thus has the same effect that very slightly lengthening the pipe would have.

120

767. *A large open wood flue pipe* is sharpened by cutting the body of the pipe shorter, and flattened by nailing a piece of board as far over the open end of the pipe as may be necessary to make it give its true note.

768. *A small open wood flue pipe* has a metal shade fixed into the upper end of the back of the pipe. To flatten the pitch, this shade is bent down towards the orifice of the pipe; to sharpen it the shade is raised.

769. As the Compound stops have several pipes to a note, and all these would of course sound at the same time, a small *mop* (*fig.* 120) is thrust into each pipe of the given key, excepting the one about to be tuned, to silence them. Sometimes the various ranks of pipes that form a Compound stop are governed by as many small sliders, capable of being drawn separately. Where this is the case, mops are not used, as

the small special slider to a single rank of pipes can then be drawn without disturbing any of the others.

770. *Stopped metal pipes*, whether entirely or partially closed, are furnished with a cap, and by this they are occasionally tuned. By pressing this cap down, the vibrating column of air within the pipe is shortened, and the sound of the pipe is therefore raised, and *vice versâ*. In England, stopped metal pipes, which have generally very large ears, are more frequently tuned by those ears. By bending them nearer towards the mouth of the pipe, they lower the pitch; and by bending them outwards, they, on the contrary, raise it. In modern specimens, both in England and Germany, the pipes are made sufficiently long to receive cylindrical wooden stoppers covered with leather.

771. *Stopped wood pipes* are closed with a stopper, that is, forced *into* the upper end of the pipe; and in this respect differs from the cap of the stopped metal pipe, which *encloses* the top of the body. Its influence, however, is the same, namely, that of sharpening the pitch of the pipe the further it is pressed down, and of flattening it the more it is drawn upwards.

772. *Reed pipes* are tuned by means of the tuning-wire, on raising which the vibrating portion of the tongue is lengthened, causing it to give a deeper tone; and on depressing which the vibrating portion of the tongue is shortened, and the pitch consequently raised.

The pitch of the organ altered by the heat and cold in different seasons. The extent of this alteration.

773. The pitch of the organ is affected to a considerable extent by the altered temperature of the atmosphere at different seasons of the year. This fact was satisfactorily elucidated by the late Dr. Smith, Master of Trinity College, Cambridge, who has given the result of his experiments in his work on *Harmonics*, page 192, 2nd edition :—"I found," he says, "that the particles of air in the cylindrical pipe, called d^1, in the middle of the open diapason, made 262 complete vibrations, or returns to the places they went from, in one second of time. This experiment was made in the month of September, at the time when the thermometer stood at temperate, or thereabouts. But, upon a cold day in November, I found, by a like experiment, that the same pipe gave but 254 complete vibrations in one second; so that the pitch of its sound was lower than in September by something more than $\frac{1}{4}$ of a mean tone."

774. "And, upon a pretty hot day in August, I collected, from another experiment, that the same pipe gave 268 complete vibrations in a second of time; which shows that its pitch was higher than in November by almost half a mean tone."

775. "By some observations made upon the contraction and expansion of air, from its greatest degree of cold in our climate to its greatest degree of heat, compared with Sir Isaac Newton's theory of the velocity of sounds, I find also that the air in an organ pipe may vary the number of its vibrations made in a given time in the ratio of 15 to 16, which answers to the major hemitone, or about $\frac{7}{12}$ of the mean tone, and agrees very well with the foregoing experiments."

776. The influence of a change or rise in the temperature on the pitch of an organ is sometimes rather strikingly illustrated during the evening meeting of large congregations, and also in concert-rooms; and it is not unfrequently also attended with some temporary inconvenience. On account of the church or room being filled with people, the temperature soon rises, the atmosphere in and around the pipes of those parts of the organ that are exposed to it undergoing a similar change. The metal pipes themselves also become warm from the heated air coming in contact with them, some metals and compounds, however

being sooner influenced than others. When the parts of the organ in question are played, supplied as they then are by a warm air, and with their pipes also warm, they are found to sound much sharper than before. The Swell pipes, however, supposing the shutters of the box to have been kept closed, are surrounded by an atmosphere of the original temperature, the heat not having been able to penetrate through the box, they, therefore, remain cool, and the warm air from the bellows as it passes into them becomes chilled, and is reduced to its original density; the consequence being that the Swell, at its unaltered pitch, sounds, perhaps, a quarter of a tone flatter than the Great organ. This non-accordance of pitch is often very detrimental in its effect; but it can generally be obviated by fixing the Swell open, whenever the organ is not being used during the evening, so as to allow the warm air to reach its pipes, and raise their pitch with the rest of the organ. Care should afterwards be taken to leave the Swell open all night, that its pipes may cool with the other parts of the organ, or it may be too sharp when next used. The writer has known a concert-room organ to rise as much as a semitone in pitch in the course of an evening's performance, when the temperature has very much increased.

777. When an organ has been thrown much out of tune by a great change of temperature, it will be found that the flue stops are not so much at variance among themselves, nor the reeds, as that one class of stops has bodily separated from the other. This change is commonly attributed to the reeds, which are said to have "gone flat"—reed pipes being rather proverbial for their instability of pitch;—but in this instance the alteration appears to rest rather with the flue stops.

778. A simple and ready illustration of the influence of heat in raising the pitch of a flue pipe may be obtained in the following way:—Take out the top pipe of the Dulciana, if it be in tune, and hold its body in the hands until it becomes perfectly warm, and then return it into its place, and sound it with the stopped Diapason. It will then be found to sound very sharp. This is because the warm pipe raises the temperature of the air as it passes through it. If the two pipes are allowed to continue to sound together, a rapid beat will at first be heard; but, as the current of air gradually cools the pipes, the beats will become slower, until they at last entirely disappear, as the pipe, on attaining its first temperature, returns to its original pitch.

779. As to the cause of the change of pitch, from alteration of temperature, some have been inclined to attribute it partly to the expansion of the metal in warm weather and its contraction in cold, and partly to the lighter density of the atmosphere in summer than in winter. Dr. Brewer, in his little work on *Sound and its Phenomena*, page 255, says: "The reason is, an increase of temperature increases the *elasticity* of the pipes, in consequence of which they vibrate somewhat more quickly, and render a higher note." This refers to flue pipes. With regard to the tongues of reed pipes, which are of brass, as the heat expands them, it would be supposed that they would vibrate slower, and produce a lower sound; but, if their elasticity also is increased, the one influence may to some extent balance the effect of the other.

780. As being connected in some degree with this subject, reference may be made to the cause of the draught that is so generally felt to issue from the region of the keys of the organ. The warmer atmosphere, as it comes in contact with the numerous metal pipes, becomes chilled; and, its density being increased, it descends. In this manner a constant eddy is produced, resulting in the disagreeable effect referred to, and which has been attributed to almost every cause but the right one.

CHAPTER XXVIII.

THE PITCH TO WHICH AN ORGAN SHOULD BE TUNED.

The question a most interesting one.

781. THE question as to the pitch to which an organ should be tuned introduces to consideration several very interesting particulars. A concert-room organ would probably be tuned up to the prevailing concert pitch, in order that it may accord with the orchestral instruments. With regard to church organs, however, this same question cannot be so easily disposed of. Several circumstances first demand attention, particularly when the organ is for a church where choral service is celebrated.

The presumed lower pitch of two centuries since.

782. Much has been written at various times to show that the musical pitch has been gradually rising for the last two centuries; and the opinion has even been expressed that in Tallis's time it was some two tones lower than it is now.

The difficulties inseparable from that theory.

783. The difficulty, or rather impossibility, has been to reconcile this theory with the *notation* of the venerable pieces of church harmony of the sixteenth and early part of the seventeenth centuries. All who have been accustomed to assist in the choral performances of the services and anthems of the early English church composers must have observed that the parts, generally speaking, lie so low for the voices that they can be sung only with some difficulty, even at the present supposed elevation of a major third above the original pitch; and this circumstance has naturally led to much speculation as to whether they ever *could* have been sung at a pitch much, if at all, below that in present use.

784. Several different theories have been propounded, with the hope of settling this by no means unimportant question.

785. Some have supposed that the range of the human voice must have been lower at that period than it is now; others, that the composers could not have studied the compass and convenience of the voices for which they wrote; while others maintain that the compositions in question were not contemplated by their authors to be sung to any definite pitch, but were intended to be transposed, to suit the voices, as occasion might require. All these explanations, however, are accompanied by some circumstance that proves fatal to its unqualified reception. Let us examine them in the order they are given above.

The compass of the human voice supposed to have changed.

786. It must be needless to insist on the extreme improbability of the supposition that nature has found it necessary to *revise* that which has always been ranked among her most perfect works—namely, the vocal organ of the human species—particularly as there exists no real difficulty to render the retention of so unseemly an hypothesis necessary. But were it otherwise, the questionableness of such a theory is soon rendered evident by making an analysis of the music of the period already alluded

to. In the Services of Tye, Tallis, Byrd, Gibbons, Bevin, Farrant, Hilton, and others, the *notation* of the treble part in no case ascends higher than d^2, the fourth line in the treble; while in a few instances it descends as low as tenor a, the second line below. The bass constantly ranges down to FF, and sometimes even to EE; and the inner parts lie proportionably low. The anthems of the same composers slightly exceed the above upward range in the treble part; but that only rarely. Now, if the *pitch*, at the time alluded to, were some two tones lower than at present, the above writers must have considered the *sound* corresponding with the modern b^1 flat, or b^1 natural, the third line in the treble, as marking the full average upward range of treble voices, and an occasional tenor f, the fourth line in the bass, as not too low for them; and further, they must have viewed DD flat, and even CC, the second line below the bass, as sounds quite within the range of ordinary bass voices;—ideas certainly most opposed to our knowledge and experience of the compass and capabilities of the several voices in existence in the present day. But inasmuch as the theory of the former existence of a complete series of different, that is, deeper voices, rests solely on the presumed lower pitch of the seventeenth century—and this latter point is not yet proved—its further consideration may, for the present, be withheld.

The old composers supposed not to have consulted the convenience of the voices they wrote for.

787. With regard to the second suggestion—"that the composers could not have studied the compass and convenience of the voices for which they wrote"—the answer to this must depend entirely on the decision arrived at in reference to the former question, and, therefore, may also stand over for a time.

The early English composers supposed to have written without regard to any definite pitch.

788. The third supposition is "that the compositions in question were not contemplated by their authors to be sung to any definite pitch." This, however, does not meet the difficulty. Unless the old English treble voices were as deep as the modern counter-tenors, and all the other voices proportionably low, Tallis, Gibbons, and the other church composers of the period, must invariably and intentionally have written their music in a pitch in which it could *never* have been sung, and have thus rendered recourse to transposition not simply a matter of *occasional expediency*, but one of *constant necessity*. Nay, more, as the services, &c., were *from the first* intended to be accompanied by the organ (the composers themselves, in many cases, taking their seat at the instrument), and as the organs of that day were tuned according to the *unequal* temperament;—as, moreover, the music was generally written in the scales *provided* by that temperament, but *out* of which, according to the above theory, they must uniformly have been transposed;—it follows, if the above hypothesis be correct, that the learned composers referred to must have avoided the *good* keys in performance, and used the *bad*. Now, it is not possible that proceedings so needlessly complex and objectionable as those just detailed could have been recognised, still less have received *preference*, at the hands of those who were, in all other respects relating to their art, such methodical and deep-thinking men.

Everything questioned except the presumed lowness of the old pitch.

789. In the attempted solutions hitherto advanced, the judgment of the great English composers of the time referred to, and even the original perfectness of some of Nature's own work, the compass of the human voice, have been questioned, while one thing, the mutability of which is so well known, namely, the *pitch*, has been treated as though it was indisputably a very low one in the sixteenth century

Strong grounds for believing in the former existence of a high ecclesiastical pitch

790. Now, although the opinion is directly at variance with all the hitherto received notions on the subject, there are the strongest reasons for believing that the ecclesiastical pitch of the sixteenth and early part of the seventeenth centuries, so far from being some two tones lower than now in use, was a *whole tone higher than the present concert pitch.*

The sixteenth and seventeenth century organs in Germany a whole tone sharp.

791. During several visits to the organs of Germany, the writer was frequently struck with the extreme *sharpness* of the pitch of the *old* organs. Of the three great instruments at Hamburg, two—namely, those in St. Catharine's Church, which is the oldest, and that in the Church of St. Jacobi, built in the seventeenth century (see Foreign Organs in Appendix)—proved to be a *whole tone* above the writer's tuning-fork, marked "Philharmonic" pitch. The transept organ in St. Mary's Church, at Lübeck, another *old* instrument, on being tested, was also found to be a whole tone above the same pitch; while that in one of the other churches in the same old town was a full semitone above the same pitch. On the inquiry being made of the organists of the three fore-mentioned churches how they accounted for this circumstance, they explained that their organs were tuned to the *church* pitch; and it subsequently transpired that in Germany three distinct standards of pitch had at different periods been used to which to tune organs; namely, orchestra pitch, which was the lowest; chamber pitch, a semitone above the former; and church pitch, which was the highest. On extending these inquiries to an organ-builder of that country, that person stated that he had almost invariably found the old organs, which he had been called upon to tune, repair, or replace by new ones, a semitone or a whole tone sharper than the present concert pitch. Not the least interesting proof of the former existence of a high church pitch is to be found in the fact that Sebastian Bach, in his church Cantatas, in most cases, wrote the *organ* part *a note lower than the other parts;*—which circumstance is alluded to by Mr. Macfarren, in his analysis of the contents of the first volume of Cantatas, published by the Leipzig Bach Society, printed in the *Musical World* for 1853.

A high ecclesiastical pitch believed to have existed formerly in England as well as in Germany.

792. The above facts, in conjunction with others, tended to confirm an opinion the writer had long previously entertained, namely, that in England, as in Germany, there must have existed at the period of the Reformation, and from that time to that of the Rebellion, a church pitch quite separate from the orchestral or instrumental pitch; and not only so, but even higher than the modern concert pitch. Every circumstance directly supports this hypothesis, which at the same time removes and reconciles all the difficulties and improbabilities which have encumbered every other view of the same subject.

The very low notation of ancient church music favourable to this view.

793. To begin with a reference to the English church music. If we read the notation of the old services *a tone higher*, the average compass of the treble parts will then be made to the extent from middle b or c^1 up to e^2 or f^2; and the bass parts, as a rule, not lower than gamut G or FF; precisely the ranges which are known to be the best for the corresponding voices in church music. By this very simple means the necessity is obviated for supposing that the range of the human voice has undergone any modification; it removes all occasion for suggesting that the whole race of church composers of the sixteenth and early part of the seventeenth centuries understood

or studied the convenience of the voices so little as invariably to have written *too low* for them; and it renders it quite superfluous to suppose that that industrious class of writers made a practice of setting their services and anthems in *wrong keys*, leaving singers and organists to transpose them into the correct ones. William Turner, writing in 1724, says: "When Guido Aretinus reduced the Greek scale into the form now used, there was no sound practised above *E la*, which gave birth to the common proverb, viz., He strains a note above E la." Without going back so far as this quotation would take us, if the pitch in Tallis's time had been some two tones lower than at present, it is difficult to comprehend a cause for treble voices having to strain at c^2; but, if it were a tone higher, it is easy to understand that then, as now, the *sound* of f^2 sharp could only be produced by some exertion.

794. Soon after the above observations were first written, two interesting facts came to the writer's knowledge, which strongly supported the opinion as to a former high church pitch. In the library at Exeter Cathedral is preserved a MS. copy, written about the beginning of the last century, of Tallis's Service in D, transposed into E; and in Dr. Rimbault's library is a copy of Gibbons' Service in F, transposed into G; in both cases the *notation*, no doubt, being *raised* to compensate for the *lowering* of the *pitch*, in order that the originally intended sounds might be preserved.

795. In 1644 church organs were ordered to be demolished by Act of Parliament; and so implicitly was the nonsensical decree obeyed that very few organs escaped the general destruction; and even the two or three that were spared have subsequently undergone so much alteration in the course of improvement that they could afford little or no assistance in solving the question which has just been considered.

796. A few incidental references as to the pitch of old organs have, however, from time to time come to light, which clearly proves the existence of a high *church* pitch in the seventeenth century. The elder Harris built an organ for Magdalen College, Oxford, in the early part of the seventeenth century, which was repaired by his *grandson* in the years 1690-91. Among other necessary improvements he undertook to "alter the pitch of the said organs *half a note lower* than they now are." Among the memoranda of Dr. Woodward, Warden of New College, Oxford, under the date "March 10th, 1661," occurs the following:—"Some discourse was then had with one Mr. Dalham, an organ-maker, concerning a new fair organ to be made for our college chapel. The stops of the intended organ were shown unto myself and the thirteen seniors, set down in a paper and named by the organist of Christ Church, who would have had them *half a note lower* than Christ Church organ, but Mr. Dalham supposed that a quarter of a note would be sufficient."

Father Smith's pitch flatter than the ecclesiastical pitch of preceding times.

797. The organs built by Smith and Harris after the Restoration were not tuned to so high a pitch as the choir pitch of the time of Tallis and Gibbons, and Smith's pitch was higher than Harris's. Smith's pitch was, however, higher than some have supposed, as may be gathered from the following passage, extracted from *The English Musical Gazette* for January, 1819:—"It is a remarkable circumstance that all Schmidt's organs were a quarter, and some even half, a tone above pitch; this was so severely felt by the wind instruments, at the performances of the Sons of the Clergy, that they could not get near the pitch of the organ. In consequence of this, it was agreed upon that the organ should be altered to concert pitch, by transposing the pipes, so that the present DDD was formerly CCC, and so on through the organ." To this it may be added,

that the pipes to the CCC key are new ones, the two open Diapason pipes, of wood, standing in the angles of the case to the left of the manuals. The pitch of the Temple organ was also originally rather sharp. Harris's organs were lower in pitch than Smith's. The lower pitch of Harris's organ was one of the specified causes of its rejection at the Temple. The matter is thus referred to in an extract printed in Mr. Macrory's excellent little book, *A Few Notes on the Temple Organ*:—"The organ made by the said Harris is discoverably *too low* and too weak for the said church." The portion of this organ that was afterwards erected at Wolverhampton remained at the low pitch until about twenty years since, when it was raised by the late Mr. Bishop. Smith's pitch was almost the mathematically correct one, if not absolutely so. Harris's lower pitch he no doubt brought with him from France, where the organ in the King's Chapel and all the famous organs in Paris and in the country were tuned *a semitone lower* than the King's chamber pitch. As the pitch of the C in the time of the eminent violin maker, Stradivarius, was that of 512 variations in a second of time, and very probably agreed with the chamber pitch, the greater gravity of Harris's pitch can be traced to its source and cause, and its disagreement with Smith's accounted for.

The flattened pitch accompanied by a raised notation.

798. On referring to the sacred compositions by the contemporaries of Smith and Harris, we perceive this coincidence in support of the opinion that the pitch of that period was flatter than the earlier choir pitch; namely, that certain notes, such as e^2 and f^2, which scarcely ever appeared in the treble part of the earlier church music, were now of quite common occurrence.

The pitch lower again, at the commencement of the eighteenth century, in England.

799. Soon after the commencement of the eighteenth century the pitch had again fallen. Possibly Harris's flatter pitch was preferred, and accepted as the standard. It is known that the organ in the chapel of Trinity College, Cambridge, commenced by Father Smith, and "cut down" and finished by his son-in-law, Schrider, in 1708, was originally adjusted to the pitch which has been shown mathematically to have been a minor tone below the present pitch. The writer of the *Reformation of Cathedral Music*, page 25, says: "Dr. Smith (*Harmonics*, 1749) gives 393 as the number of vibrations of A in a second. Fisher, in 1823, gives 430. Woolhouse ascertained the Philharmonic pitch, in 1835, to have 424. The same note referred to the scale of vibrations C = 512, and derived as a prime harmonic from the subdominant F, will have 426·6. Now the ratio of any of these to 393 is almost exactly as 10 : 9, which is the ratio of a minor tone, showing the rise of pitch within a single century."

A similar alteration of pitch, at the same period, in France and Germany.

800. What is very remarkable is, the pitch had, soon after the commencement of the last century, fallen as much in France and Germany as in England. Of the three fine organs at Strasburg, built by Silbermann, those in the cathedral, finished in 1716, and that in the Protestant church, proved, on trial in 1853, to be *a whole tone below* the pitch of the same fork by which the Hamburg organs were tested the preceding year, and found to be *a whole tone sharp*. The third organ, in St. Thomas's Church, is nearly as flat. The organ in the Church of St. Maria di Capitol, at Cologne, built in 1767 by Konig, was also originally flat, and, like the Trinity organ, has since been sharpened.

The lower pitch in the last century accompanied by a further ascent in the notation.

801. In this case, again, the greater *depression* of the *pitch* is manifested by the increased *upward* range of the *notation*, as is clearly demonstrated by the music of Handel and other composers of the last century, even without the authority of Handel's tuning-fork, the existence of which further authenticates the supposition. William Turner likewise speaks of the treble voices in his time going some three or four degrees higher than Guido's gamut, which, however, would then have consisted of the same range of *sounds* as in Tallis's time, or within a semitone of it.*

802. It is evident, then, (1) that the organ pitch has within three centuries varied to the extent of two whole tones; (2) that there have at different times existed three distinct pitches, the highest being the oldest; that in use soon after the commencement of the last century being the lowest; and (3) that the present pitch is about midway between the extreme high and low pitches of former times, and is as nearly as possible identical with Father Smith's.

To which of the three church pitches formerly in use should a church organ be tuned?

803. The question now is, to which of these three different pitches a *church* organ had better be tuned, seeing that music has been written to *all* of them, yet but *one* can be adopted? As the *medium* pitch is at the same time also the true mathematical one, there can be no doubt but that, theoretically speaking, it would be better that all organs be adjusted to a fork that gives that true mathematical pitch, such as that published by Mr. Hullah, and issued by Messrs. Longman and Co., Paternoster Row; but complaints are so frequently made by members of congregations, on the one hand, and by singers who have to perform the solo and verse music of the last century, on the other, of the inconvenience of singing to the present high pitch, that it is worthy consideration whether it would not be as well to have organs tuned exactly a semitone flat, for the general convenience of the voices, and then for such music to be transposed as may be required, and into such keys as would best suit the particular congregations or choirs. At any rate, it is clear that, to be adequate to the purposes of transposition, all organs should be tuned on the equal temperament system. In that case, music could be transposed by easy semitonal gradations, either upwards or downwards, or by whole tones, without involving crude results, which could not be accomplished on an organ tuned in any other way. Recently the question as to the desirability of a recognised lower Diapason has been under the consideration of the Royal Society of Arts, and has also met with two able advocates in Mr. John Hullah and Mr. G. A. Macfarren.

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* It is, perhaps, worth mentioning, that several pieces by Handel have lately been transposed into *lower* keys, and printed, with the view of *restoring* their original pitch.

Division VII.

CHAPTER XXIX.

ON THE CORRECT USE OF THE STOPS.

804. HAVING, in a preceding chapter, given an account of the several organ stops commonly found in English organs, a few words may now be added as to their object and use, as well as their effect when sounded singly or in combination.

805. On a correct knowledge of the nature, quality, and pitch—whether indicated by name or by figures—of the different organ stops depends the good or bad effect of even the best organs. Without a clear perception of what is right in these matters, it is impossible that a performer can be *sure* how, under what circumstances, and for what ends, this or that combination of stops may be the most seasonably employed. However scientifically the organ-builder may have fixed and deduced his scales, voiced his pipes, and truly balanced their tone; however strictly every rule necessary to the production of a "good organ" may have been observed in constructing the instrument; all these important preliminaries, necessary towards a becoming and decent accompaniment to the music of the church, will be of little avail if the mind that is to direct their use is but imperfectly stored with the knowledge necessary to secure their proper application. Nor can this knowledge be obtained from books beyond a certain extent; for a combination of stops that will answer a particular purpose in one organ often will not do so, at any rate to the same extent, in another, on account of the different size or proportions of the building in which the organ stands; the varied strength of tone of the similar stops of different instruments; the situation of the organ in the church; or even the locality of the stops in the organ itself—for the exigencies arising from which circumstances, or a combination of them, no book could provide. It is, therefore, incumbent on every organist rather to endeavour to ascertain for himself the peculiar excellencies, and, perhaps, defects, of the individual instrument at which he is chosen to preside, and so discover the method of applying the former to special purposes with the best effect, and of hiding the latter as far as may be.

806. There are certain general and fundamental rules, however, concerning the appropriate method of combining the stops which may be pointed out. Besides the combinations about to be specified, others of a less common kind will be found to follow the suggestions for the introduction of certain stops in the specifications given in a subsequent chapter; beyond which, as has been already said, all must be left to the organist's good judgment and the capacity of his instrument.

General rules for the use of the stops.

807. The first step essential towards a correct knowledge of the right use of the stops is an acquaintance with the general method of combining the members of the three great classes of

"Foundation, Mutation, and Compound" stops, so as to secure, in all cases, the predominance of the foundation tone.

808. The Foundation stops, as explained in a preceding chapter, produce a sound agreeing in name with the key pressed down; and are of 16, 8, 4, and 2 feet on the Manual, and of double size on the Pedal.

809. The larger Foundation stops will, for certain purposes, produce an appropriate effect alone; as, for instance, the 8 and 4 feet flue stops, or the 16, 8, and 4; or, in some cases, the 16, 8, 4, and 2 feet.

810. The Mutation stops—*i.e.*, the Fifth, Tenth, Twelfth, Tierce, Larigot, &c.—are not intended to be used alone, the class to which they belong being designed expressly for the filling up of some of the intervals between the Foundation stops, and for so doing away with the leanness of bare octave-work. They depend on the first class of stops for their good effect, and must not, therefore, be employed without them. In using the Mutation stops care should be taken that the Foundation rank, the *next smallest* in size, is also drawn with it to *cover* it; otherwise its sound will appear too remarkable, and perhaps even offensive. Thus the Twelfth should always have the Fifteenth drawn with it; and the Tierce or Larigot, the octave Fifteenth, at any rate in the bass.

811. The Fifth and Tenth, being *Double* Mutation stops, forming the Twelfth and Tierce to the Double Open Diapason, constitute no part of the *Unison* harmonic series; for which reason they should never be drawn without their fundamental stop of 16 feet. An exception to this rule is sometimes made abroad, with good effect, on the Pedal, concerning which more further on.

812. The Compound stops can only be successfully used when blended with some Foundation and Mutation stops.

813. The Foundation stops give distinctness, the Mutation stops fulness, and the Compound stops brightness and point to the general organ tone.

The character of tone of some of the leading stops; and the purposes to which they may be applied.

814. The Unison stops are, of course, the most important in an organ, as they are also generally the most numerous. In drawing any of these separately, or blending them together, attention should be directed to their various qualities of tone. Some stops possess a character that renders them more applicable to one kind of music than to another; and, again, some mix better than others together.

815. *Open Diapason.* The tone of this stop is full, sonorous, and solemn. It is the one best adapted for the performance of slow music in dispersed harmony, particularly when there are many suspensions occurring in the progress of the piece. The Stopped Diapason is advantageously added to the Open Diapason, when used as above, to give body to the pure sounds of the open pipes; and the Dulciana, if there be one on the same clavier, is also drawn, as adding slightly to the general effect. All reedy-toned flue stops, as the Gamba, &c., are foreign to the purpose, as interfering with the smooth and *velvety* tone of the best English Diapasons.

816. The *Stopped Diapason* is fluty in its character of tone, and free from all reediness or roughness. Generally speaking, it tells better, when used singly, for solo purposes than for full harmony, its tone not usually being sufficiently sonorous for the latter purpose. In short passages of tranquil character it can be used with charming effect. As a combination stop, it is one of the most useful in an organ. It is the best one to use with the Clarionet, with the tone of which it blends admirably, or with the Swell Hautboy, when the latter is to

be employed as a solo stop. In certain cases it forms an excellent accompaniment to a single voice, being very prompt in its speech, as well as light and travelling in its tone. The Lieblich Gedact, as a Choir organ stop, forms an excellent accompaniment to the Swell Hautboy.

817. *The Dulciana* is usually a stop of great delicacy, smoothness, and gentleness of tone. Its sound is lighter than that of the Stopped Diapason, but clearer and of a more singing character. It is the most used singly as an accompanimental stop to some of the solo stops on the other Manuals, as the Stopped Diapason in the Great organ or the Hautboy in the Swell, its own situation being usually on the Choir Manual. The Dulciana may, however, be effectively employed as a solo stop in the treble part in cantabile passages, with the Diapasons in the Swell (closed) by way of accompaniment, and also much in the same way as the Open Diapasons; *i.e.*, in full harmony, to which stop it may be considered as a diminutive or echo.

818. *The Gamba*, from the resemblance of its tone to that of stringed instruments, is peculiarly well adapted for four-part playing, particularly for music that has many chromatic progressions in the harmony. When of weak intonation, it tells best by itself; but, when of strong tone, it sounds better when blended with the Stopped Diapason, Clarabella, or German Hohl-flote. For accompanimental purposes it requires to be used with some caution. A Gamba of strong intonation, used alternately with Stopped Diapason and Stopped Flute (one of them of metal) on another Manual produces a most charming effect. The pungent tone of the former, followed by the liquid tones of the latter combination, presents a most exquisite contrast. What has been said of the Gamba applies mostly also to the Keraulophon and other *reedy*-toned unison flue stops.

819. *The Clarabella*, from its powerful fluty quality, forms an excellent unison solo stop by itself at times when a strong and decided flute tone is required. As a combination stop, for use with the Clarionet or Hautboy, it sometimes imparts too much body to render the imitation close.

820. *The Trumpet* in the Great organ is seldom used as a solo stop. When it is so, it should always be accompanied by the Diapasons. When thus blended it sounds well, if played in harmony; in major keys its effect being grand and dignified, and, in minor, solemn and impressive. Diatonic progressions of harmony are better suited to the tone-character of this stop than chromatic. The Swell Trumpet is much used for choral accompaniment, as well as for solo playing; and the same may be said of all the other full scale unison reed stops of that department. When employed for the former purpose, it has the Diapasons drawn with it; and often, also, the Principal and smaller stops, according to circumstances. As a rule, all reed stops should have some unison flue stop or stops combined with them, to add body to the penetrative and powerful character of that produced by the reeds.

821. *Clarionet.* The best flue stop to draw with the Clarionet is the Stopped Diapason; as this not only mixes well with the former, but does not give more body and thickness to the tone of the stop than it should have in its imitative capacity, and it is not generally used in any other. This stop is often used, among other purposes, for playing out the whole or a portion of the melody of a psalm tune upon. For an accompaniment thereto the Swell Diapasons and Hautboy answers well, with a couple of soft stops (16 and 8 feet pitch) for a Pedal bass.

822. *The Hautboy*, as already intimated, when about to be used as a solo stop, will tell best with the Stopped Diapason only added. The instrument itself

(Hautboy) is by nature but of thin tone; hence, to preserve the resemblance between the tone of the original and the prototype, a flue stop of light but firm tone is the most appropriate to be employed. When used for the purpose of accompaniment to voices, the Hautboy stop tells best combined with both the Diapasons, and perhaps, also, though not always, with the Principal, which latter stop will sometimes blend and sometimes not, according to the exact character of the reed stop.

823. In blending together some of the smaller Foundation stops with the unison, for the purpose of accompaniment, they are generally taken in their regular octave progression. Thus, after the 8-feet stops are drawn, some of those of 4 feet are next brought on; and then, if necessary, those of 2 feet; but not those of 2 feet first, and then others of 4 feet. The Flute or Principal, or both, according to the strength of the unison tone, therefore follow the unison stops; and then the Piccolo or the Fifteenth, if necessary; and not *vice versâ*. For particular effects, unusual combinations are made; as for instance, 16 and 4 feet stops without any of 8; or 8 and 2 feet stops, omitting those of 4 feet. Such combinations produce the best effect when compounded of members of the covered or light-toned Flute-work. The tone of stops of the Open Diapason species is generally too strong and sonorous for such purposes.

On the combination of the stops for the production of any required strength of tone.

824. By means of an appropriate combination of the stops which all well-arranged or complete organs contain, any strength of organ tone may be obtained, from the softest to the loudest. The kinds of stop arrangement that will produce these several desirable and necessary gradations of sound may be distinguished by a particular letter or letters, thus: P P, P, M P, M F, F, and F F; under which heads may be conveniently given such combinations as will produce the strength of tone that the musical meaning of those letters are understood to indicate.

825. P P. For the production of a *pianissimo*, a single soft-toned 8-feet flue stop* on the Manual will be sufficient, as a Stopped Diapason, Dulciana, or Gamba, &c. On the Pedal, its own bass (16 feet) may be drawn, or, if that is not present, some other stop of an equally subdued tone. It is generally of advantage to add a "helper" (that is, a stop giving the octave above) to the Pedal; this can either be a soft Pedal stop of 8 feet, or the Manual stop coupled to the original Pedal stop.

826. P, for *piano*, all the smooth-toned Manual 8-feet flue stops. On the Pedal, the corresponding 16-feet stops should be drawn. The addition of an 8-feet open stop will in many cases improve the effect of the Pedal; but, if a stop of this kind should not exist in that department, one of a similar nature can be borrowed from the second Manual; or the first Manual may be coupled to the Pedal.

827. M P, a *mezzo piano*, is gained by adding the 4-feet flue stops of the Manual (Principal, Flute, &c.) to those already named, and those of 8 feet to the Pedal.

828. For the production of a medium strength of tone between the two last-given gradations, combine all the *soft* 8 and 4 feet Manual stops, as the stopped Diapason, Dulciana, and Flute. These together possess more brightness, but less fulness, than the former, and less roundness than the latter.

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* The size of stop here spoken of may or may not be its standard size. When, in organ music, "8-feet flue stops" are directed to be used, the expression is understood to mean the combination of all stops, except the reeds, that give the 8-feet sound. This interpretation is always accepted when speaking of the *use* of the stops.

829. M F. A *mezzo forte* is produced by adding the $2\frac{2}{3}$-feet and 2-feet stops (Twelfth, Fifteenth, &c.) on the Manual to those of 8 and 4 feet and those of $5\frac{1}{3}$ and 4 feet to the Pedal.

830. F. For a *forte*, the collected Compound stops may be brought into play. When a medium between the two last-mentioned gradations is required, only one Compound stop need be drawn.

831. FF. A full climax is secured by adding the reed stops (Trumpet, Clarion, &c.) to the foregoing.

832. A medium may here again be obtained by adding the 8-feet reed stop only to the flue stops previously drawn out.

833. The Manual 16-feet flue stops (*doubles*) have not been specified in any of the above gradations, because it is not so much the nature of such stops to add power as weight, gravity, and solemnity to the tone of the other stops. Their use with or rejection from any particular combination, therefore, does not so properly come under consideration when the question of *strength* of tone is being discussed as when that of *character* of tone is being treated of. Almost any combination, whether loud or soft, may receive the accession of a 16-feet stop with advantage under particular circumstances. Thus, some soft or moderately strong combinations that would, perhaps, give a tone approaching towards joyfulness become imbued with a more serious character when a stop of 16-feet pitch is added thereto, and is therefore rendered a more fit accompaniment to music of a sad character. A strong combination which possesses the brilliance and point of the Mixture work, and perhaps also the impressiveness of the reed stops, acquires weight and magnificence from 16-feet Manual stops, particularly if they are accompanied by double Mutation stops and a 16-feet reed stop.

834. Moreover, the organ should be used in a somewhat different manner when any 16-feet Manual stops are drawn; otherwise the excellent effects which that class of stops are especially calculated to produce will be to some extent obscured. The omission of all "doubles," as a rule, from the Manuals of English organs until of late years rendered it compulsory on organists to invent a sort of substitute for them *in effect;* for it was found that the organ tone lacked the requisite gravity and dignity, however numerous the *unison* stops might be. Performers on that instrument, therefore, had to lay aside the purer and more strict style of playing as being "ineffective," and to fall back upon the system of keeping some eight or nine notes down at a time to draw from their instruments anything approaching a broad and massive character of tone. Latterly, the serious omission above adverted to has been supplied by addition to old organs and by incorporation with new ones; and the care already hinted at, as being required in playing on an instrument possessing so valuable an acquisition, consists in not adopting so full a style of playing when the 16-feet stops are drawn as when they are not. The former is viewed as rather a complicated *substitute* for the latter; and if *both* are had recourse to simultaneously, the one is most likely to destroy the effect of the other. A very charming contrast may, however, frequently be produced by accompanying a chant or chorale, sometimes in four parts *with* the doubles drawn, sometimes in about six *without* them.

835. It may be mentioned here that many object to the doubles being used in accompanying vocal compositions in the fugal style, particularly at those points where the subject is led off by one of the higher parts. There is much reason in this objection, although it only applies to the precise times specified. The doubles may between whiles be introduced with even greater effect when the voices are

moving in harmonic masses. For the best illustrations of the occasions when the 16-feet stops may or may not be used in choral accompaniment, the organ part to *Israel in Egypt*, written by Mendelssohn for the Handel Society, may be consulted with the greatest advantage.

836. When the organ is being used as a *solo* instrument—*i.e.*, in voluntaries—the above objection does not hold good. The doubles cannot then interfere with or mislead any voices. Moreover, the tradition throughout Germany is that Sebastian Bach *generally* played his fugues with the doubles drawn; therefore those who would aspire to perform his works after his own manner can only do so by frequently availing themselves of that dignified class of stops. As to the "octave below" being discernible at the starting of a fugue, there is no doubt that any moderately educated musical ear can detect *any* interval or stop in an organ that it cares to listen for, whether it be the Double Diapason, the Tierce, the Twelfth, or what not; but that affords no sufficient ground for the exclusion of any of those stops. Besides, even supposing the doubles to have an undesirable effect for some half dozen bars in the course of a musical composition, if it has a most advantageous influence in the remaining hundred or so, which fact is beyond question, the far greater evil would arise from their *exclusion*. The fact is, no single rule would be a good guide in this matter. The "lead" in the first movement of the "St. Ann's Fugue" sounds bad with the doubles; that of the last movement as ill without them.

837. Neither has the influence of the *Swell* been included in the foregoing scheme for producing various degrees of strong or weak tone. The Swell is of inestimable advantage for all classes of accompaniment, as it enables the performer to increase the tone when the voices may be getting flat, and to decrease it when all is going well. This power is independent of, and supplementary to, that of imparting expression to the music, which latter attribute is of such peculiar value, as well as being highly acceptable to those who have true appreciation and sound musical feeling.

On the adaptation of the organ tone to the true purposes of choral accompaniment.

838. In applying the various combinations and resources already specified to the purposes of choral or congregational accompaniment, there are many circumstances to be taken into consideration, and which ought always to influence the selection. The first and greatest of these is, of course, the prevailing character of the words about to be sung, whether they are jubilant or supplicatory, and with which the accompaniment should always accord, so that it may produce a suitable impression. A musical composer, when scoring a secular work for an orchestra, employs those instruments the quality and character of tone of which are the most applicable to the subject of the words and the spirit of the music. An organ being the more seemly substitute for an orchestra in a church, and containing, as it does, imitations of most of the orchestral instruments, an organist should, by a skilful combination of its different stops, adapt the tone of the instrument to the sense of the words and the character of the music that are being sung, in order that the result of his rightly directed efforts may be as appropriate and acceptable as possible. When it is recollected how much pains is taken with the accompaniment to heighten the effect of music, some of which is avowedly written chiefly for man's amusement and pastime, it is obvious that at least the same amount of care should be exercised to secure an equally appropriate accompaniment to those vocal strains which occur in the edifying services of the church. An organist cannot be too mindful of this, nor can he exercise too much forethought and discretion in making this most important condition of the utility of his office legitimately perceptible. It is in this particular, of all others, that he has the opportunity of showing his

superiority over the mechanical work of a self-acting instrument. A barrel organ can be made to execute music with the utmost precision and finish; it may even be made to shift its own stops; but it cannot be endowed with the *reason* necessary wherewith to direct the *application* of these combinations to their special purposes. A *mind* must be in active operation to do this worthily; and herein lies the secret of an organist's great advantage in performance over an instrument from which the choral accompaniment is "ground" out. Nothing can be less acceptable than to hear bright stops used, and an animated style of playing adopted, when the words are prayerful or supplicatory; or, on the other hand, to hear only heavy stops brought into requisition when the subject is a jubilant one. Every large and well-designed organ necessarily contains many stops that are appropriate and inappropriate for *all* occasions; and it is, therefore, capable of considerably heightening or of injuring the effect, according to whether its powers be rightly directed or not; and an organist who misses their judicious application, whether from causes resting with himself or from the influence of others, is open to the supposition of being disregardful of the trust reposed in him, and may, therefore, hazard the respect due to his office —consequences against which every organist should guard himself by the exercise of his best powers of discrimination.

839. After ascertaining the prevailing character of the words, the next point to be considered is the exact *quantity*, as well as description, of loud or soft tone that the circumstances of time and place would seem to suggest as the most appropriate to the occasion. As the number of the congregation will vary on different occasions, so also will the strength of the united voices of its members. The amount of organ tone, therefore, necessary for directing and giving support to the voices of a full congregation will consequently be too much when there is but a "thin attendance." Particular care, therefore, should be taken to modify the tone in some way, so that it may not be too strong for a reduced number of voices, and yet strong enough to prevent the congregation singing out of tune or time. The simplest way of lessening the strength of the accompaniment, without destroying its spirit and character, is to draw, on the second or third Manual, stops of the same size, and perhaps name, that one would use on the first, if the concourse of persons were larger. Any modification in this combination that the peculiarities of the particular organ might render necessary would, of course, be taken into account. With the resources at his command which every parish church organ ought to possess, and which many do, an organist ought to find no difficulty in accommodating its tone to any exigency that may arise.

840. At the same time that every organist should view his calling as a high one, demanding the exercise of great intelligence as well as technical knowledge in the fulfilment of its duties, it should also be borne in mind that the introduction of organs into churches, and their judicious employment there, are but means to the attainment of certain ends. What those ends and objects may be will be best gathered from the following quotation from the introduction to Schneider's *School for the Organ*, which well describes what is looked for from the church organs and organists of Germany :—"An organ consecrated to the sanctuary and to sacred music is intended to be subservient to the edification of a congregation assembled together for divine worship; to support and to accompany, in a proper manner, the singing; and to be instrumental in promoting a devotional frame of mind and the edification of the soul, and its elevation above everything earthly, to the contemplation of things invisible and divine—a noble object, which can only be obtained by a style of performance suited to the holiness of the place and the

sacredness of the subjects. The proper management of this sublime instrument can induce a devotional spirit and an elevation of mind in the scientific hearer, as well as in any individual of feeling. The sound of the organ is able to insinuate itself by mild and tender tones, and then the mind is filled with the pious tranquillity of filial devotion; but it can also elevate itself to majesty and pomp, and peal and roll like storm and thunder, and then it elevates our hearts with sublime emotions. Whilst most other instruments can only express individual feelings, this kingly instrument can produce a variety of emotions. The organ alone can best fill with its tones the lofty vaults of the vast cathedral, support the singing of large congregations, and, by its power, operate upon the religious feelings."

Division VIII.

THE CAUSE OF MANY FAULTS IN AN ORGAN, WITH THEIR REMEDIES.

CHAPTER XXX.

841. It is important that an organist should be in a position to ascertain the cause of the faults existing, or occasionally appearing, in his organ; and also what are the steps necessary to be taken to remedy them. Some derangements arise from such simple causes, and can be so easily set right, that an organist might remove them himself, if quite certain of the seat of the disorder; and, by so doing, save the organ-tuner perhaps a long journey to rectify what may not occupy him ten minutes when he is there. Schneider, in his *Organ School* (page 60, first English edition), expresses himself on the above subject in the following words:—"It is, generally speaking, necessary for the organ-player that he should make himself as intimately acquainted as possible with the internal construction of the organ, with the nature of every single part, the combination of which constitutes its whole; as well of the particular parts of the mechanism which cause the pipes to sound, as also of the nature, peculiarities, and properties of the pipes themselves, in the manifold variety of their make and the various kinds of sounds which are constantly produced; by which means alone a right and appropriate style of managing the instrument, and one in all respects suitable to its nature, can be attained. But as regards a regularly appointed organist, the knowledge is absolutely indispensable; for it is his first duty to take care of his instrument, to preserve it, and carefully to look after it—a duty which can only be fulfilled when he is able to discover immediately the cause of those derangements in the mechanism, &c., which are unavoidable in that instrument, composed of so many diversified parts; and even to remedy the defects himself, in many cases, when an organ-builder may not be immediately at hand. If the organist, thus acquainted with the construction of the organ, fulfils that duty to the fullest extent, and, in those cases for which he does not find himself competent, procures promptly the assistance of some qualified person, an organ may continue for a long time in a sound condition, and a more extensive repair be rendered unnecessary for a considerable period. On the contrary, an ignorance of the construction of the organ, and negligence in the care of the instrument, and also with respect to getting small defects remedied, always leads to inevitable and more considerable damage; and not only do expensive repairs become requisite, but also an instrument thus neglected can often only be restored in a very imperfect manner."

THE UNBIDDEN SOUNDING OF A PIPE FROM CAUSES IN THE REGION OF THE PALLETS.

Ciphering caused by dirt on the pallet.

842. Among the numerous faults and derangements to which all organs are at times liable, one of the most frequently

recurring is that known as a "ciphering;" in other words, the sounding of a pipe, on the drawing of a stop, without any key being pressed down. A ciphering may arise from various causes. Some grit or chips may have worked down from the pipes, through the table and the channels of the sound-board, to the surface of the pallet; and, by resting on its edge, and holding it a little way open, thereby admit sufficient wind into the groove to make the first stop sound that is afterwards drawn. A derangement from this cause is frequently indicated by the controlling key being a little below the level of the others. To remedy it, the front-board of the wind-chest must be taken off, the pallet drawn open, and its surface carefully wiped, as well as that part of the groove against which it "beds," with some dry, rough substance, to remove the impediment.

843. To facilitate the rectification of such casualties, some German organ-builders fasten on the front-board with large wooden screws, having sexagon heads, so large that they can be turned by the fingers alone; so that, in the event of a pallet becoming deranged during the service, the organist can get at it with little loss of time, without the aid of noisy tools, and perhaps put it to rights before the organ is again required.

Ciphering from a pallet-spring being too weak.

844. Or the ciphering may be caused by the pallet-spring being too weak to cause the key-movement to return quickly, and the pallet to thoroughly close over the pallet-hole. If this is the cause, the key will rise sluggishly, and only partially; and the ciphering will continue till the key has been raised to its proper level by the hand. In this case, a piece of coiled wire, similar to that on the fourth string of a violin, and called by organ-builders "check-spring," may be fastened to the tracker, outside the wind-chest, and to some neighbouring wood-work, which will assist the return of the movement, and accelerate the closing of the pallet. Or, still better, the weak spring can be removed, and replaced by a stronger one.

Ciphering caused by the pallet catching on a direction-pin.

845. Sometimes a ciphering will be caused by the pallet descending too low, and catching on one of the side direction-pins, an accident that is likely to occur if a key be struck too violently and suddenly. To cure this, the front-board must be taken off, and the pallet released. In some German organs the two side direction-pins are omitted, and one pin of extra stoutness introduced instead, and placed in the centre of the *front* of the pallet, where a small vertical groove is cut in the pallet, to allow the pallet to descend and ascend without leaving the pin.

Ciphering from damp loosening the leather; or heat warping the pallet.

846. A ciphering will frequently arise—particularly in instruments that are so situated as to be exposed to the changes of atmosphere in an aggravated form—from the damp in winter loosening the leather from the surface of the pallet, allowing it to swerve from its place over the pallet-hole, and admitting wind into the groove; or from the heat in summer warping the pallet as it dries it, and, by destroying its evenness of surface, preventing its bedding properly over the pallet-hole. To remedy either of these derangements, the pallet has to be taken out; and, in the one case, the leather has to be fresh glued on to the pallet; while, in the other, the pallet has to be planed down afresh, newly faced with leather, and then re-fastened to the sound-board.

847. The pallet in some French sound-boards is made without leather pallet-hinges, but with simply a pin passing through a puncture in the tail end of the pallet for the pallet to work upon. This arrangement presents the advantage of allowing an almost instantaneous substitution of a sound pallet for a defective

one ; and it also admits of the immediate resumption of the use of that pallet, instead of its remaining idle for many hours while the glue is drying. It also admits of the easy cleaning of the joint end of the pallet, which is always a tiresome operation with pallets fastened on in the usual way.

Ciphering caused by a pull-down being rusty

848. A ciphering is sometimes caused by a pull-down having become rusty, which causes it to become fixed in the hole in the brass plate through which it ought to pass, and holding the pallet a little way open. This fault can generally be remedied by drawing the pallet open, and cleaning the pull-down with scouring paper ; care at the same time being taken not to bend the wire, which would establish another source of ciphering.

THE UNBIDDEN SOUNDING OF A PIPE FROM FAULTS IN THE KEY-MOVEMENTS.

Ciphering from some adhesive substance falling between the keys.

849. A ciphering will sometimes be caused by some derangement of the key-movement. Commencing at the keys, one of the commonest causes of ciphering is the falling of melted wax or tallow on and between the keys, which will attach two together. This is soon remedied by carefully scraping the sides as well as the surface of the keys with a penknife, to remove the cause of adhesion. Or it may be caused by dirt or a pin having fallen between two keys. The best way to proceed to remove the impediment, in that case, is to "work it out," which may be effected by taking hold of the two keys, in front, with the thumb and forefinger of each hand, and raising the one key at the same time that the other is lowered ; drawing them apart with a certain amount of firmness, without violence, to encourage the impediment to fall.

Ciphering caused by a key warping.

850. Another cause of a sticking at the key is its warping from excessive heat, which causes it to rub against its neighbour, and become fixed. The eye will easily discover whereabouts the key is out of the parallel, if it is in the fore part of the key, as well as the probable point of contact. To remedy this, the key has to be removed from its place, and either scraped, or a few very fine chips pared off from the part where it touches the next key ; which may be done sufficiently to ease the key, without disfiguring it. To remove the key, the book-desk has first to be taken out ; and, if the disarranged key is in one of the lower sets, the upper must be lifted out, to lay the right Manual bare. Modern organs are usually so constructed that the Manuals can be moved in or out with little more difficulty than the drawers of a chest of drawers, which is a most convenient arrangement.

Ciphering from a sticker binding.

851. Sometimes a sticker will "bind" in the hole in the register through which it should move, from damp swelling both portions of the wood-work, whereby the hole in the register becomes smaller, and the sticker larger. This can be cured by taking out the sticker, and either filing the hole in the register a little larger, or by scraping the sticker. Or the sticker may bind, from the black-lead having worn away from its surface ; in which case more might be added with a black-lead pencil, without, however, damping it.

Ciphering caused by a backfall getting off the sticker.

852. In a backfall movement, a ciphering will sometimes be caused by the backfall shooting off the sticker, under the influence of a violent blow on the key, and catching on the top of

the sticker-pin. To set this right, it is simply necessary to press the sticker-pin carefully, but firmly—without, however, bending it—into its place under the drill-hole in the backfall, and lowering the backfall into its right place. On doing this, the key will resume its proper level.

Ciphering from grit in the centre-holes; or by swelling of the movement.

853. A ciphering will sometimes be caused by grit, dirt, or small wood or metal chips working into the pin-holes of some part of the movement, or between a square or backfall and the frame; which, by preventing the complete action of the movement, will hold the pallet a little way open, and also cause the key to remain a little way down. By tapping the key rapidly, the fault will frequently correct itself, and save further trouble: if not, it must be sought for through the movement, and removed. Or some part of the movement may have swollen, and be thus made to bind too tightly on the pin. This might be rectified by cutting the centre-hole the least degree larger; but if the fault only appears in damp weather, and then only slightly, it is usually better to leave it to be corrected by a drier and warmer atmosphere: particularly as the wood, by contraction at such a time, might otherwise leave the pin-hole sufficiently large to cause a looseness of action and a rattling.

THE UNBIDDEN SOUNDING OF A PIPE FROM DEFECTS IN THE SOUND-BOARD.

854. A running. One of the most tiresome and vexatious defects which can occur in an organ is a *running*, because the region of the disarrangement is frequently one of the most hidden parts of the organ. Its seat is always the sound-board, or immediately adjacent parts, and it consists of an unbidden sounding of a second pipe on the sounding of a first, which may arise from a variety of causes. The pitch of the second sound, however, will sometimes assist one in discovering the seat of the disorder, if some allowance be made for its pitch being *flat*, and its sound not well defined, on account of the defect frequently being produced by a very small quantity of wind, which *breathes* rather than *blows* into the pipe. For this reason, the evil is not apparent when all the stops on the sound-board are drawn; for then there are so many outlets for the fugitive wind, that it disperses and escapes without producing any audible effect; but when one or two soft stops only are drawn, then it frequently becomes painfully so.

A running caused by an upper-board being too loose.

855. A running may arise from an upper-board not being screwed down sufficiently; which is soon remedied by tightening the screws in the immediate vicinity of the pipe originally sounded. Or it may be caused by a leakage from one groove to the next. Whether it arises in this manner will be indicated by the pitch of the unbidden sound, when compared with the plantation of the pipes. If the pipes are planted semitonally, as in plan 2, and the secondary sound is the half-tone above or below the tone sounded; or if the pipes are disposed tonally, as in plans 1 and 3, and the unbidden sound is a tone above or below that produced in the usual way, the defect will, in either case, be traceable to the above-mentioned cause.

A running caused by a sound-board bar separating from the table; or by an unsound bar.

856. Or a sound-board bar has "sprung"—*i.e.*, has become partially separated from the table; or a small crack has "started" in the sound-board bar itself, allowing a little wind to pass through from one groove to the next. To stop this, the crevice

is well covered with paper, coated, and saturated with glue. Sometimes, to cure this fault, recourse is had to "bleeding," which, however, is only an objectionable method of hiding the fault.

A humming caused by one slider touching and partly drawing a second.

857. A disagreeable humming, not unlike a running in effect, although it is not in reality one, will sometimes be caused by one slider rubbing against the next as it is being drawn, and partially drawing that also, causing a little wind to pass into the pipes of a second stop. In this case the effect will be like a running of an aggravated kind, inasmuch as the defect will appear to exist on nearly every key of the Manual. The unbidden sounds will be rather lower in pitch than the correct sounds, though scarcely amounting to a semitone. To remedy this evil, a peg might be driven in between the two sliders, or one of them might be planed at the edge to prevent its touching the other. As the objectionable custom of placing two, or even as many as three, sliders together, without intermediate bearers, is entirely discarded by all modern organ-builders, the liability of a humming from the disarrangement last named is confined to old organs. When it occurs, all the stops that are not actually in use should be pressed in.

A humming caused by pipes standing in too close proximity.

858. Sometimes the unbidden sounding of a second pipe will arise from the pipes being packed too closely together, so that the wind that passes out at the mouth of one pipe enters that of another, causing it to produce a moaning sound. This evil is frequently not an easy one to remove. The primary cause of this is the sound-board being too small, which leads to the pipes being placed in too close proximity. In some cases this defect can in a manner be cured by turning the mouth of one of the pipes in another direction; or by mounting the pipe on a longer foot; or by conveyancing it off to another situation. The most thorough cure for such an evil, however, is the introduction of a new and larger sound-board.

DEFECTS IN THE KEY-MOVEMENT.

A springing in the key-movement.

859. A Manual key will sometimes go down about half-way, under the pressure of the finger, without causing any sound; after which something will appear suddenly to snap, and the key will descend the remainder of the distance with a run, the organ at the same moment sounding. This disagreeable effect is caused by the roller being too weak. Instead of its setting the second arm in motion, the instant the first one is operated upon by the key, the roller "springs" or twists for a time, until it has in this manner derived a sufficient accession of power to give a tug at the pallet; the resistance at which being thus overcome, the pallet starts down, giving to the touch the tiresome breaking sensation already noticed. This can only be cured by introducing stronger, or thicker, or iron rollers.

A dead resistance opposed to the finger by the key-movement.

860. In some cases, a key will at first altogether resist the touch of the finger, and will not move until the pressure has been much increased, when it will suddenly give way, and descend, accompanied by a sharp clacking noise. This defect, quite as annoying as the last, is found more frequently in old organs than in new, where the roller-arms are of iron, instead of wood, with metal tracker-hooks attached in both cases. The iron, after a few years, rusts, causing a grating and biting, instead

of a free and immediate action, which leads to the dogged resistance experienced at the keys. New wooden roller-arms are the only cure for this fault.

A thumping at the keys.

861. A thumping will sometimes be heard as the keys go down. This will be the case if the layers of cloth or baize under the front of the keys have become hard, or are too thin. The fault is easily remedied by the substitution of soft and thick baize, or by the addition of an extra layer.

A rattling in the key-movement, from the noisy nature of the materials.

862. The original key-movements of old organs were frequently so noisy, rattling, and squeaking, and their every motion so audible, that whatever the organist played seemed to have the questionable addition of a "castanet" accompaniment. This offensive interruption arose from metal having been used where wood has subsequently been found to be so much superior. The cause of the rattling was this. On touching a key, the first tracker-hook produced a "click" as it struck against the first *iron* arm; the second iron arm produced a similar noise on coming in contact with the second tracker-hook; the "metal against metal" not only produced a squeaking or a grating as the parts moved, on the finger descending, but, when the finger left the key, and the movement returned, the tracker-hooks vibrated and chattered in the holes of the iron arms. Thus a rustling and sometimes also a chirping noise accompanied the action of the movement when it ascended, as well as when it descended. The removal of the cause of the defects noticed in the two preceding sections will lead to the disappearance of those just noticed.

863. In modern organs iron roller-arms are almost always avoided, even when the rollers themselves are of that metal, and wooden ones introduced, as being far more quiet in their action. Even in the few instances where the contact of metal with metal cannot be avoided, as at the junction of the tracker-hook with the pull-down, some organ-builders do not allow the two pieces of metal to touch, but "bush," *i.e.*, line the loop of the pull-down with cloth, to silence the action. For the like purpose of lessening the friction and quieting the motion, other organ-builders introduce into each of the studs which support the rollers a kind of leather button, in the centre of which the roller-pin noiselessly works.

A rattling sometimes caused by trackers flapping together.

864. Sometimes, in "extended" key-movements, a noise will be caused by the long trackers flapping together. This is soon remedied by introducing an additional register. As, however, every additional register, or comb, adds to the friction, to avoid this latter, some Continental builders carry the trackers over little box-wood or ivory reels, by which means they are supported and steadied, without the touch being made heavier or more sluggish.

A key down without producing any sound.

865. Occasionally a key will be found to have sunk—*i.e.*, it will be down—without, however, causing any ciphering. This will arise from some connecting portion of the key-movement having slipped or given way. For instance, it will occur if either of the tracker-hooks is broken; and it can, in that case, soon be remedied with a fresh piece of wire. Or, if the rollers are provided with wooden roller-arms, and the union of the roller-arms with the trackers is effected by means of tapped wires and buttons, it will sometimes arise from the button slipping down the tapped wire. In this case, all that is necessary to correct the disarrangement is to screw the button up

again, which is done by turning it to the *right*. The tracker, however, should be held firmly, immediately above the tapped wire, to prevent its twisting, or a cause of second derangement may arise while the first is being removed. A dumb key will sometimes be caused by the breaking of a square, a casualty to which squares are very liable if they are formed of one piece of wood only, so that the grain of the wood necessarily crosses one of the arms. To cure this fault thoroughly, and prevent its recurrence, a new and stronger square must be provided.

The touch of the Manuals too shallow at certain seasons and too deep at others.

866. In warm, dry weather the touch sometimes becomes "shallow," and the pallets do not open sufficiently; consequently the pipes sound out of tune, from the inadequate supply of wind, particularly in the bass. In cold, wet weather the touch on the contrary, becomes "too deep;" which change renders the playing more difficult, and also causes a tendency to ciphering, from the keys then pressing against the thumping-board, and producing the same effect as its being slightly held down by the finger. The variations in the depth of the touch are caused solely by atmospheric change; the heat, by drying and contracting the building frame and key-movements, slackening it; and the damp, by swelling and expanding them, tightening the touch. There are several ways of remedying these faults.

867. Most modern organs are provided either with small wedges, placed under each end of the square or backfall frame, immediately over each Manual, or with screws; the former of which are pressed in or drawn out, and the latter turned down or up, according as the touch requires deepening or being made shallow. The touch of the entire row of keys can thus be altered in a very few minutes. In older organs which have not these facilities, the depth of touch can only be regulated by screwing or unscrewing the button of every key separately, which process consumes a great deal of time. To make a key "higher," the button must be turned to the right; to make it "lower," it must be screwed to the left. While this is being done, some one should be at the keys, who, by passing the fingers lightly over the key being regulated and its neighbours, will ascertain whether the key is on an exact level with the others; and if it is not, he will call out whether it is required to be "higher" or "lower" to make it so.

An unevenness in the level of the keys of the manual.

868. A single key will sometimes be out of the level with the other keys. If it is below, without causing a ciphering, the irregularity is most probably caused by the button having slipped, which, in that case, must be screwed up again; and a second one might be added, and screwed up close to the first one, to assist it. If a key is above the proper level, without causing a ciphering, it has probably risen from the rapid return of the movement, on the quick or sudden removal of the finger from the key. A slight tapping on the key will generally be sufficient to cause it, or the movement, to adjust itself.

A key screwed up too high sometimes causes the speech of the pipes to tremble.

869. A key that is screwed up rather too high will frequently cause the pallet to open and close slightly and rapidly, admitting a small quantity of wind into the groove by fits and starts, and imparting to the speech of the pipes an effect not unlike that produced by a tremulant when in motion. To stop this it is simply necessary to unscrew the button a little. A key that has slightly deepened from change of weather will sometimes produce this effect.

A ciphering caused by the breaking of a pedal-spring.

870. A ciphering is sometimes caused by the spring that should raise a pedal having broken, whereby the weight of the pedal-key drags on the movement, and has the same effect as the weight of the hand on a Manual key. If a Manual remains coupled to the Pedal while this fault exists, it will cause an apparent ciphering there also, but which will be found to have no real existence on disconnecting the Manual, as the supposed derangement will then immediately disappear. If the Pedals are only furnished with bell-springs, they will be very noisy, as well as more liable to the above accident, and should be removed, and better springs provided.

DISARRANGEMENTS CONNECTED WITH THE DRAW-STOP ACTION AND SLIDERS.

A draw-stop rod will sometimes come out too far, or go too far in.

871. A draw-stop rod will occasionally come out far beyond its proper distance, and will also return too far, and that without affecting the stop, which will be either always in or always out. This fault arises from the connecting-pin at one of the centres having worked out; and it may therefore occur either at the junction of the draw-stop rod with the trundle-arm, of the second trundle-arm with the trace, the trace with the lever, &c. All that is in general required is the restoration of the pin to its original position, or its place supplied by a new one.

A draw-stop is sometimes very stiff.

872. Sometimes, on the contrary, a draw-stop is very difficult to draw; in the language of organ-builders, it is "stiff." This derangement is generally caused by atmospheric change. In damp weather the upper-board and slider become swollen, and, by pressing against each other, increase the amount of friction. The consequent stiffness is usually removed by slightly loosening the screws, which fasten down the upper-board, which allows the slider more liberty. On the re-appearance of warm weather, and the subsequent drying, shrinking, and return of the wood-work to its original and precise dimensions, the screws should of course be tightened again. In hot weather, however, as well as in cold and damp, a stiffness will sometimes appear in the action of the draw-stops; but in this case the cause would be the warping of the upper-board or slider, which would lead to a "binding" of those parts. An abatement of the heat would be accompanied by an abatement of the fault. In the course of time, however, it may happen that if the screws of the upper-board are loosened sufficiently to remove all stiffness from the draw-stop, a running will be heard; and, on tightening them, the stiffness will return. This is an evidence that the repeated changes of temperature and condition of the atmosphere have had the effect of permanently disturbing the accurate adjustment of the several parts to one another. When this is the case, the upper-board requires to be removed, the slider taken out, and the several parts "eased" at those points where the binding occurs.

DEFECTS IN THE BELLOWS AND THE WINDING OF THE ORGAN.

A creaking from friction at the centres.

873. One of the most frequently recurring faults in a bellows, fortunately, is generally one of the most easy to cure; namely, a squeaking or creaking. This commonly arises either from the friction of the bellows-handle on its centre, or from a similar rubbing at the junction of the

pump-rods with the lever or feeders ; and is removed by simply applying a little grease.

A clacking, caused by hard valves.

874. A clacking will sometimes be heard at the moment that the feeders are drawn up. This is only perceived in old bellows, and is caused by the valves being made of wood, covered with leather that has become hard, descending on the bottom-board with an audible blow. To remedy this, new leather valves must be substituted for the noisy old ones.

A gasping, from the valves being too few and small.

875. A rushing, gasping sound may occasionally be discerned, as a feeder descends and inhales a fresh supply of wind. This occurs when the valves are too few in number, or are too small, or do not open sufficiently. The wind then forces its way through the gratings or orifices under the valves with so much additional force as to cause a whistling as it goes. To cure this, additional valves must be made.

Bellows work quicker in hot weather.

876. In very dry seasons the contents of the bellows will sometimes be exhausted much sooner than at other times. This is partly owing to the contraction of the wood of the ribs, which opens the pores, and partly to the shrinking or curling of the leather valves, which together cause more or less wind to escape. Generally this is only a temporary derangement, which a change of weather will rectify ; but, should it prove otherwise, the assistance of the organ-builder should be at once secured, as the restoration of a firm and steady wind is of vital importance to the intonation of the organ.

Bellows produce a cracking sound after damp weather.

877. After damp weather the bellows will frequently produce a sharp, tearing sound when they are first blown, particularly if they have not been used for some days. This, however, does not announce any real accident, though its cause might lead to one. In damp weather the coat of glue with which the inside of the ribs is covered, to close the pores, becomes softened, which causes the ribs, as they lie together, to adhere slightly. When the bellows are subsequently blown, the sticky and adhering surfaces of the ribs are separated after some resistance, producing at the same time the sound above noticed.

Tremulousness, from the length and elasticity of the column of wind.

878. Sometimes the working of the bellows affects the speech of the pipes, *i.e.*, a slight waving or forcing of the tone will be heard at the moment the feeders commence and complete their operation. This arises from the additional compression which takes place at the moment that the feeder and the surface-weights alternately exercise their influence. The feeder, before it can introduce fresh wind, has to overcome the pressure of the surface-weights by the exercise of *more* than an equivalent force ; and, when this under and upward pressure ceases, the surface-weights and top-board return and descend upon the wind with all their original pressure. In this manner a series of little jerks are given to the wind at the commencement and completion of each stroke, which are sometimes communicated to the speech of the pipes, particularly if the wind-trunks are small or long. To remove this defect, a concussion-bellows is usually applied ; but a more effectual remedy would be the introduction of wider, shorter, and more direct wind-trunks. When the wind-trunks are small or long, and the supply of wind to the sound-board barely adequate, the column of wind becomes more elastic ; in consequence of which, not only is every little and perhaps unavoid-

able defect at the bellows conveyed to the pipes, but it is also exaggerated. When, on the contrary, the wind-trunks are broad and short, the column of air has greater firmness, from its greater bulk, and is less elastic from the same cause, aided by its lesser length, consequently, it is not nearly so liable to communicate every little disturbance at the bellows to the speech of the pipes. In many large organs built in recent years the admirable custom of inserting a second or local wind reservoir near to the sound-board has been resorted to, which is of course the most thorough way of guarding against the evil.

Tremulousness, from shortness of supply.

879. Sometimes if a chord be held down with the right hand in the treble, on adding a three-part chord with the left hand in the tenor, the treble pipes will be weakened in their speech for a moment, and then will recover themselves; and, on withdrawing the left hand from the keys, the treble pipes will "raise their voices" for an instant, and then reduce their tone to the usual strength. These defects are sure indications of the wind-trunk, or the wind-chest, or both, being too small. In other cases an organ will stand the above test successfully; but if chords be held down in the treble and tenor with the two hands, and a disjunct passage be played upon the pedals in the bass of the Manual, a tremulousness in the tone will appear in the upper parts. This will show that the wind-supply at the grooves is still inadequate, from one or other of the causes already mentioned.

Unequal intonation, caused by small grooves and pallet-holes. A robbing.

880. In some organs it is found that certain stops sound sharper and brighter, or stronger, when tried by themselves; and flatter and duller, or weaker, when used with the others. This serious fault rests either with the grooves which do not hold sufficient wind to supply all the pipes effectually, or with the pallet-holes which do not admit the necessary quantity. The "robbing" usually manifests itself most strongly in the lowest octave or octave and a half of the sound-board. It almost invariably appears in old sound-boards, and is not always absent from new ones. There are many simple ways of ascertaining whether a Manual organ is properly supplied, or not, with wind in the bass. If, on drawing the Mixtures by themselves, and holding down one of the lowest keys, the pipes sound firmly in a certain pitch, and with a certain amount of strength, and if, on adding the other stops, the Mixtures fall in pitch and become more quiet in their tone, it is clear that the grooves either do not hold, or do not receive sufficient wind. Or, if the reeds be drawn alone, and they speak with a certain amount of crispness, promptness, and strength, but, on adding the other stops, the reeds sound tamely, sluggishly, and more quietly, it is evident that the demand on the wind in the grooves is greater than the supply. The only effectual remedies for this defect are either "double palleting," or the introduction of a new and larger sound-board with more capacious grooves in the bass (or, with double grooves), and with larger pallet-holes and pallets. In the absence of this the small stops have to be tuned in the bass, with all the stops on the sound-board drawn, that allowance may be made for the *flattening* effect caused by the robbing; and this is why the small stops sound sharper and, perhaps, tremulously when tried by themselves, at which time they receive their full supply of wind. The excellent plan has sprung up within the last few years of introducing two or three sound-boards instead of one, and of making the treble part distinct from the bass. This effectually puts an end to all "robbing."

A hissing, arising from an escape of wind.

881. Sometimes a hissing or whizzing sound is heard to emanate from some part of the organ. The sound itself is, perhaps, scarcely perceptible, but it arrests the attention by its continuance. The exact place where it occurs is frequently difficult to discover. An engineer has an advantage over an organ-builder under parallel circumstances, for in a steam engine the locality of a slight leakage is immediately made evident by the escaping steam turning to vapour and attracting attention; whereas no such assistance appears in an organ to guide the builder to the seat of an analogous fault. This is frequently ascertained by means of a lighted candle, the flame of which will flicker as it draws near to the place where the escape is taking place, and as it gets into the unusual draught caused by it.

882. The hissing frequently arises from an escape of wind at the joint of one of the wind-trunks; which will be caused by the leather covering having become loosened, from damp, age, or decay. This is remedied either by glueing the eather down again; by applying a fresh strip of leather if the other is unsound; or even by fastening a piece of thick paper over the little hole, saturating the stopping with glue. An escape of wind will sometimes take place at the side of a pull down, through the hole in the brass plate; particularly if the action of the pull-down has worn the hole into an oval shape.

FAULTS CONNECTED WITH THE SPEECH OF THE PIPES.

Small pipes are frequently dumb, tremulous, or weak in their speech.

883. It frequently happens, particularly with regard to small open flue pipes, that a pipe will be "off its speech," *i.e.*, will not sound, or it will sound tremulously, or with less than its proper strength. A most frequent cause of this fault is *dust*; a very small portion of which—so small that it would not affect the speech of a large pipe at all—being sufficient to render a small one dumb. If the fault is a general one throughout the organ, it can only be remedied by a thorough cleaning. If there are only isolated instances here and there, they can be rectified by taking the few pipes out, one by one; wiping the surface of the languid, and carefully dusting the nicking, and clearing the wind-way with a fine brush, or by blowing into it with the mouth.

Flue pipes become unequal in their strength and quality of tone from various causes.

884. Sometimes an irregularity will be caused in large or small pipes by some disarrangement of the pipe itself. The upper lip may be pressed in too far, or not far enough; the under lip may have met with a similar temporary derangement; or the languid may be too high or too low. The foot-hole may have become slightly contracted from the pressure of the body of the pipe upon the foot; or it may have become too large from the partial decay of the apex of the foot. Any one of these accidents would affect the intonation of the pipe, causing it to sound too loud or too soft, tremulously, or in the octave above; and it is often more difficult to discover what may be the true cause of the fault in any individual instance, than to correct it when it is found out. A pipe that sounds too loud sometimes has its tone softened by pressing the under lip a little nearer to the languid, which reduces the width of the wind-way, and therefore allows less wind to enter the pipe; and by altering the position of the upper lip in the same direction. A pipe that sounds too weakly frequently has its power increased by the opposite process.

A pipe sometimes sounds its octave, from the effects of dut or over-blowing.

885. A pipe will sometimes "sound its octave;" and stops of small scale, as the Dulciana, are particularly liable to such derangement. This may be caused by a little dust having fallen into the wind-way, or by the pipe having rather too much wind, or even by simply a change of temperature. All stops of slow speech, "heavy intonation," as the Germans have it—as, for instance, the German Gamba—also are liable to casualties from similar causes; and, like the Dulciana, may be thrown off their speech, if the bellows do not give a perfectly equal blast. A pipe that has too broad a wind-way, or an insufficiently high mouth, will also speak its octave.

The tone of wood pipes influenced by change of temperature.

886. Wood pipes are much influenced by change of temperature. In rainy weather the damp, by swelling the fibres of the wood, presses and closes the pores; and, by thus rendering the wood more compact, firm, and sound, improves and strengthens the tone. In very wet seasons, however, it is possible that the change may so far affect a pipe as to lessen the height of its mouth; and, by swelling the block, lessen the breadth of the wind-way, which would have the effect of slightly flattening its pitch, as well as perhaps affecting its speech. In an organ that is placed in a damp situation, these vexatious changes and derangements are both frequent and unavoidable. In dry weather the wood may shrink and become more porous, the tone then being weaker. The height of the mouth, from the excessive dryness and contraction of the wood, may be increased, as well as the breadth of the wind-way, which would raise the pitch of the pipe, and perhaps also alter its speech. The influence of these changes is the most discernible in the large open wood pedal pipes, which frequently will sound fuller in wet than in dry weather.

Stopped wood pipes sometimes deranged by heat and drought.

887. Stopped wood pipes are in summer occasionally put out of order by the stopper shrinking and falling into the pipe, raising the pitch, and destroying its quality. The stopper must, in that case, be taken out and restored to its proper place; some means being at the same time taken to make it fit tightly. This can frequently be done by putting a layer of paper between the stopper and the leather cover on all four sides. Or an additional covering of thin leather might be put over the stopper, if this will not make it fit too tightly. If a stopper that fits too tightly be driven into a pipe, it may cause the front or back to separate slightly from the sides at the joints; and, by so causing the pipe to become unsound, render the tone false and weak. A defective intonation will arise also if the stopper is not driven in perfectly level, but sideways. Mr. Lewis adopts the ingenious device of making the stoppers of all his small stopped pipes of cork, which material is, of course, self-adjusting.

Division IX.

SUGGESTIONS FOR THE CONSTRUCTION AND ERECTION OF AN ORGAN.

CHAPTER XXXI.

888. THE preceding chapters of this work having been devoted to a descriptive analysis of the structural details, &c., of an organ, it now remains to treat of other essentials which call for the attention more particularly of those to whom the duties of preparing the specification and superintending the construction of an organ are entrusted.

THE COMPASS OF THE CLAVIERS, AND OF THE SEPARATE DIVISIONS OF THE ORGAN.

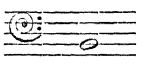
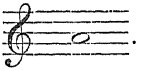
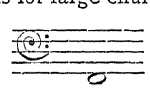
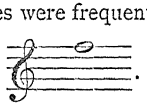
889. The first subject to be considered is the compass necessary for the Manuals and Pedal, together with their respective departments of the organ.

890. It is most desirable that patient attention should be devoted to this question, since nearly every separate compass yet devised has its advocates; yet whose opinions, when compared, are found to be conflicting. As, moreover, what is advanced in favour of one compass is not unfrequently accompanied by something else by way of objection against all or most others, it behoves all who would desire to arrive at a just conclusion on this very important subject to weigh all the arguments for and against each plan, before making a decision; otherwise, with the best intention, their efforts may only end in a perpetuation of the existing confusion.

Precedents for nearly every variety of clavier range.

891. There are precedents for almost every imaginable variety of range, both of Manual as well as Pedal; and if the selection of any one from among the number were a question of no greater moment than the gratification of individual taste, or did not involve some violation of artistic arrangement that would not militate against the proportionate development of the separate departments of which an organ should consist, nor entail the sacrifice of funds and room in its consequences, there could be no difficulty in the way of any compass whatever being adopted that fancy might dictate. But the case is far otherwise. On a just view of this matter depends the successful issue of the work; its influence pervading the arrangements of the entire instrument. It is very important, then, that the most careful consideration should be given to this subject, before proceeding any further in the work, particularly as a false step in this direction, once taken, cannot afterwards be retraced.

892. In the Historical Introduction to this book Dr. Rimbault has mentioned that in the earlier organs the number of notes were very limited: from

nine to eleven (inclusive of the one chromatic note, B flat), being nearly their greatest extent, the execution of the plain-chant not requiring more, and harmony being then unknown. At the close of the eleventh century an organ was made for the Cathedral of Magdeburg, containing *sixteen* notes, and A KEY-BOARD. In the twelfth century the number of keys was increased, and every key was furnished with two or three additional pipes, sounding the fifth and octave, or the third and tenth. In the fourteenth century an organ was built, at Thorn, with *twenty-two* keys; and besides this increase in the compass, which extended upwards and downwards, the keys were made smaller and neater, and with a lesser fall, so that they could be played with the fingers collectively and the thumb alternately. The most notable improvement effected in this century, however, was the gradual introduction of the four remaining chromatic keys. F sharp, the first sharp, was inserted in the early part of the century; afterwards came the second sharp and second flat, C sharp and E flat; and lastly the third sharp, G sharp. In 1359, or 1361, Nicolas Faber built the great organ in Halberstadt, with fourteen diatonic and eight chromatic keys, extending from  to  . From this time the organs for large churches were frequently made with a compass of three octaves, from  to  . In the early part of the sixteenth century we begin to glean something authentic respecting the compass of English organs. In 1520 Antony Duddington made an organ for Allhallow's Church, Barking, the lowest key of which is distinctly set forth in the contract as being *Double Ce-fa-ut;* the 8-feet note that marks the full downward range of the Manuals of all the English and Continental instruments of the present day. Consisting of "xxvij playne keyes" (or naturals), and, doubtless, the requisite number of short keys, the compass, if *unbroken*, must have extended to a^3 in alt; and if *broken*, that is to say, having the CC pipes planted on the *apparently* EE key, it would then have been of the four octave CC short octave compass. The latter is the more probable range, as it is that of many of the old German organs of about the same date. In 1637 Thomas Harris built an organ for Magdalen College Chapel, Oxford, which was also "Gamut in Do, Sol, Re;" and Dr. Burney mentions that, in Father Smith's time, the usual organ compass was four octaves, from CC; which range, however, was frequently departed from.

The compass of the Manuals; the confused state in which the question was involved in England; and the importance of a correct view of the subject.

893. Indeed, those who a few years ago were much in the habit of visiting English church organs, and of observing their general arrangements, were much struck with the remarkable *variation* that existed in the compass of the Manuals and Pedal of different instruments. A dozen organs might have been visited promiscuously, without any two being found to agree precisely in the above respects. Some had short-octave GG Manuals; others, GG Manuals with long octaves. Some had Manuals descending a note lower to FFF; others, Manuals to CCC; while a fifth class would have Manual organs of the orthodox CC range. There were not wanting some having three Manuals all of different ranges. Then of the Pedal: some organs had an octave of pedals commencing at GG; others, an octave and a half beginning on the same note, or perhaps on FFF. Some had two octaves of GG pedals, while others

had one octave, an octave and a half, two octaves, or two octaves and a half of CCC pedals. Such was the undecided state into which these divisions of organ arrangement had fallen in this country, previous to the commencement of the now widely-spread desire for their amelioration.

How the true Manual compass is to be ascertained.

894. That *all* the compasses for Manual and Pedal just cited can be *equally* correct, is impossible; either some are too long, or others must be too short; or, supposing a medium range to be the true one, then some must be as much too short as others are too long. The question, then, is, of the number, which is the correct compass and which not?

895. The presence of a certain number of keys on the Manual and Pedal claviers, and an equal number of semitones in their respective organs, must be necessary to render an instrument adequate to all the purposes and uses of a church organ. Do those Manuals—the question of the compass of the Pedal is deferred for the present—then, that extend only to CC, *fall short* of this needful range; or do the various kinds of long octave ones *exceed* it by just so much as their Manuals descend below that key? Or, is the medium compass, the GG, the correct one, and consequently the CC range as much too short as the CCC is too long for the required purposes? The sources to which alone reference can be made, with the certainty of finding a correct solution to the above problems, are the choral and instrumental compositions that are most frequently heard in, and which are held in the highest esteem as accessories to, the church service; and for the accompaniment of the one, and the performance of the other, the organ itself is employed in our ecclesiastical edifices. If reference then be made to the works of the long list of English choral writers, and to the scores of Handel, Beethoven, Bach, Mendelssohn, &c., this examination will be attended with the following results.

896. In the selected movements from the works originally written with orchestral accompaniments, such as the solos and choruses in oratorios, masses, &c., it will be observed that the violoncello part, which comprehends within its downward range also that of all vocal basses, *never* descends below the CC note, which note (as all musicians know) is the lowest one on that instrument. The double bass, indeed, is a deeper-toned instrument; yet, as it does not give a sound in accordance with the notes written, but the *octave below*, as far as its compass permits, its representative is correctly to be found among the unison (16-feet) flue-work of the pedal organ. Again, if the compositions written expressly for the organ by Bach, Mendelssohn, Hesse, Wely, Henry Smart, and others, be consulted, it will be seen that the greatest extent to which the Manual part of those works descends is also CC. The most elaborate sacred musical productions, then, whether they be essentially choral, originally written with instrumental accompaniments, or composed exclusively for the organ, neither require nor *recognise* a greater extent of compass downwards than that possessed by the *shortest* of the various kinds of Manual above mentioned. A few exceptions to this otherwise universally supported fact may indeed be found in the organ compositions of Samuel Wesley, Thomas Adams, and Dr. S. S. Wesley; yet these examples would scarcely be deemed sufficient to outweigh the united authority established by the various and voluminous works presented to us by the writers previously named. That the CC Manual *does* afford ample scope for the perfect execution of the *hand* parts of all descriptions of music used in the church, excepting the few excellent works already specified, has never been disputed. And that the CC Manual range is the best one for concert-room organs,

is equally beyond a doubt. So much, therefore, is greatly in favour of the CC Manual organ.

Arguments against the CC Manual compass, and in favour of a longer range.

897. Against it, and in favour of a longer compass, it has sometimes been urged (1) that in accompanying the choral service, and more particularly the quieter parts, a soft bass is frequently required (though not written) *below* CC ; (2) that if the Manual keys are made to *end* on that note, then the deeper sounds have to be obtained from the Pedal ; and (3) if that department be furnished with a fair proportion of stops, a shifting of these with every change from "Full" to "Verse," &c., becomes necessary ; or (4) if there be but one stop on the Pedal, as is too frequently the case, the choice then lies between a ponderous and heavy bass and none at all.

898. These objections are founded on the manner in which CC organs *are* sometimes made in England, rather than on the Continental system, according to which they *should be*, and occasionally are, built. It is not a correct conclusion that, if the Manual *keys* stop at CC, the Manual *sounds* must also cease there, any more than it would be that the *upward* range of an organ must cease at f^3 in alt, if the keys do so. In all two-Manual instruments of average pretension, the Great organ should have a Double Stopped Diapason (Bourdon) throughout. This is one of the *fundamental* laws of the German system of organ-building, and is *constantly* adhered to in the construction of the average church organs of that country ; and it does not follow, because the Great Manual of an English CC organ is sometimes made without a stop of 16-feet size of tone, that the inconveniences which must arise from such omission are to be attributed to a principle of organ-building, from which it is a departure. Where a stop of the kind in question *is* disposed, instead of the downward range of the deep Manual sounds being *limited* by the termination of the keys at CC, it is *increased* to the extent of seven semitones *beyond* what an old-fashioned GG Manual could produce ; so that, even on the question of "depth of tone," a CC Manual organ on the Continental principle has the decided advantage over a GG Manual organ on the English principle. Furthermore, the concentration of so many deep sounds on the Manual obviates the "necessity" for employing the Pedals so constantly, if the performer cares to dispense with the use of the latter ; and thus the second objection to the CC Manual is, to a great extent, done away with. But, even supposing the continued use of the Pedals to be desired, so far from the shifting of the Pedal stops to obtain a soft bass being a matter of "necessity," some German Pedal organs are made with a wind-trunk valve (Sperventil) to cut off the wind from the Pedal Reeds and Chorus stops, and worked by a stop-handle that is shifted as quickly as a Pedal coupler ; by means of which a soft or loud Pedal may be obtained with the greatest facility.

899. One fact relating to the subject of the deep Manual tones should not here be omitted. While the extra keys below CC are said to be so necessary for soft accompaniments, the Second Manual (Swell), on which the quieter parts would frequently be played, is always made not only *without* those very keys, but, in the great majority of cases, also *without the next whole octave above*. This important circumstance much weakens the position, as to the "necessity" for the Manual keys descending below CC, to meet the requirements of *soft* playing.

900. Nay, more ; when the Second Manual organ (Swell) in GG instruments is made to the short tenor c compass, it is usual to arrange the keys beyond to act

either on the Great organ, or on the "Pedal pipes." Now, in the former case, a shifting of the Great organ stops must be made with every change from *forte* to *piano*, and back again; in the latter, there will be the strong and unseasonable bass; so that the second and third objections, if they are such, exist, to at least an equal extent, in organs of long compass, and are not by any means peculiar to those of shorter range.

901. The CC is the only Manual range now accepted on the Continent. In Germany, Holland, Belgium, the Netherlands, Switzerland, France, America, &c., no organ is ever made to any other compass. The celebrated organs at Haarlem, Frieburg, Frankfort, Hamburg, Rotterdam, Dresden, St. Denis, Boston, U.S., &c., are all CC Manual organs.*

902. Among the 300 or 400 English organs that have been either built or re-modelled conformably with this range may be mentioned the new organ in St. Paul's Cathedral; the organs at Christ Church, Newgate Street; St. Paul's, Knightsbridge; St. Peter's and St. Michael's, Cornhill; Temple Church; St. James's, Piccadilly; All Saints', Margaret Street; St. Andrew's, Wells Street; and St. Giles's Camberwell, &c. Also those in the Birmingham, Leeds, Newcastle, Brighton, Glasgow, Edinburgh, and Dundee Town Halls; the Collegiate Institution, Liverpool; the Parish Churches at Doncaster, Leeds, Newark, Ashton-under-Lyne, &c.

Much room and a great expenditure of funds required to extend the compass of a Manual organ below CC.

903. The CC compass for a Manual organ, at the same time that it is quite satisfactory as to completeness and convenience, is far *less costly* than one of longer range; not that *cheapness* ought to be made a consideration in any case, where the object is to be devoted to the service of the church, and where the question should not be "what will do," but *what is best*. Still, it does so happen that a given number of stops to CC will cost very considerably less than when extended down to GG, or lower; and the money and space saved by observing the distinction between what is essential and what is not, are of vital importance where funds and room are objects (and where are they not?), since they can then be devoted to the proper proportionate development of other departments which are too often straitened, or altogether excluded, in order to allow of the lengthening out of a Manual organ.

904. Some idea may be formed of the extra cost of a long octave Manual organ, from the increase that is made in the price of *one stop alone* by this downward elongation. The charge for an Open Diapason to CC used to be about eighteen pounds. The cost of the same stop, extended to GG, was increased to nearly thirty pounds; with the FFF and FFF sharp added, to about forty pounds; and, when further extended down to CCC, the 16 feet pipe, and a good quality of metal preserved throughout, its cost was not far short of seventy pounds. From these few facts it will easily be seen that a hundred pounds may be soon expended in extending the stops of even a single Manual, and this, too, without extending its resources as a *Manual* organ, in any shape or way.

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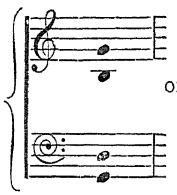
* It is worth mentioning that the Manuals of Spanish and Italian organs sometimes descend below CC. Those of the new organ at the Cathedral at Seville go down to AA; those of the two organs at Milan Cathedral descend to FFF; those of the chief organ at St. Peter's at Rome range to CCC, short octaves; while those of the organ at St. Alessandro at Milan are of CCC range, and of complete compass. (See accounts of these organs in the Appendix.)

The true method of increasing the resources of a Manual organ.

905. For an illustration of this latter fact, try two Manual organs by the same builder, furnished with stops similar in every respect only that the compass of those of the one shall stop at CC, while those of the other shall extend to GG, or anywhere else. If this



or any other chord be struck in pure four-part harmony, first on one of those Manuals, and then on the other, the sound will be found to be precisely the same in each case, both as regards quantity as well as quality; in other words the tone of the GG Manual organ will possess no advantage over that of the CC one. The reason of this is obvious. Increasing the *compass* of a Manual, and increasing its *resources* as to tone and variety, are two widely different things, and they are worked out by totally opposite processes. The former end is attained by keeping to the same stops, and augmenting their range; which is like adding a fifth or sixth string to the stringed instruments in a band, with the view to increasing their efficiency. The latter is effected by preserving the original compass (that compass being a full and complete one), and engrafting thereon other stops that emit sounds differing in pitch, or quality, or both, from those produced by the original ones; a course which is equivalent to increasing the number and variety of instruments as the means of augmenting the resources of an orchestra. As the capabilities of a band would be amplified—both in regard to its power of varied combination in the detail, and its grandeur of tone in the aggregate—by increasing the number of distinct instruments, so are the analogous powers of the organ correspondingly augmented by increasing the number of distinct stops; and they are increased *only* by this principle of development. A Manual can but be complete, let its compass be extended below CC as far as it may; even as a violin could be no more, were the number of its strings to be doubled, or even trebled. Supposing such an experiment to be tried with a violin, music for that instrument would have to be *altered*, before any use could be made of the additions as *violin* features. In like manner all church music has to be altered, before any use can be made of the keys below CC as *Manual* features.

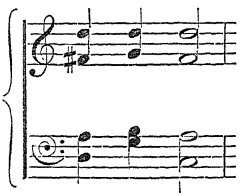
How it may be ascertained whether certain keys are essential or not as Manual ones.

906. The best proofs of there being no legitimate use for the long octaves with the *hand* are to be gathered from the deviations which it is necessary to make from the musical text, in order so to employ them. The keys, acting upon these additional tones and semitones, are placed, as a matter of course, *beyond* the CC key; and, as the Manual part of all descriptions of church music alike only extends *to* that note (as has been already shown), they are not available as above, so long as a composer's notation is adhered to. To make use of the extra notes with the hand, the hand must be transferred an octave lower than the music directs; and single notes, octaves, or even full chords, played down there; the tenor part of the composition, meanwhile, being either entirely abandoned, or thrown an octave higher; the consequence being in either case a material departure from the musical text, and a most undesirable transposition of the parts.

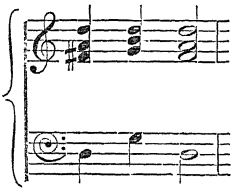
907. Speaking of the superior effect that divided harmony produces upon the

organ over close harmony, Forkel says: "By this means a chorus, as it were, of four or five vocal parts, *in their whole natural compass*, is transferred to the organ.

Let the following chords in divided harmony be tried :—



and then compare how the following,



a more common way of rendering the same sounds in comparison, and it will be evident what injury must accrue to the effect from playing a whole piece in such a manner. *In the former manner* BACH *always played the organ.*" (*Life of Bach*, Boosey's edition, page 33.)

908. Taking all the foregoing circumstances into consideration, it seems clear that the "long octaves" do not possess any real advantages as *Manual* adjuncts to compensate for their enormous cost. And it is as indisputable that their application to certain departments—say the Chief Manual, or Great organ—is often the means of excluding many of those which are so from others, of reducing the number and amount of their contents, or even of necessitating their entire omission, by absorbing for their construction a sum from the gross amount which would be sufficient to secure the amelioration of one, if not more, of the above material blemishes. A few general illustrations may be given of these last-mentioned facts. To advance more specific ones would be inconsistent with the object of the present work.

The ameliorations that might be effected on a given specification, by regulating the outlay otherwise than in the construction of unessential Manual notes.

909. If the general arrangements of a modern £400 or £500 GG organ be examined, they will in the majority of cases be found to be as follows :—

Compass of Great organ, GG to f^3 in alt, with GG sharp	59 notes.
Compass of Swell organ, tenor c to f^3 in alt .	42 notes.

The Swell Manual continued down to GG, and made to act either on the Bass of the Great organ, or on the Pedal pipes at pleasure.

Compass of Pedal board, GG to tenor c	18 notes.
Compass of Pedal pipes, from CCC to CC	13 pipes.

910. From these particulars we perceive that, while the Chief Manual or Great organ is carried *half an octave lower* than CC at a considerable cost, the second Manual organ (Swell) is discontinued *a whole octave above* that note—the funds *then* not admitting of the latter department being made complete—and the Pedal organ consists of "half" a stop, and *that* sounding an octave out of pitch. Now

it need scarcely be urged that the only particular in which the two Manual organs ought to differ from each other are the number of stops, or their strength of tone, and not in the *compass*, which should be the same in either case; for what is required for "soft accompaniments" is a Manual with stops of a subdued tone, and not without any bass to it. In fact, the longer compass has sometimes been declared to be more specially needed for soft accompaniments.

911. The old organ-builders, although compelled to make instruments to all kinds of compass, and thus to give an air of vacillation to some of their arrangements, but for which they must not be held responsible, and, for reasons already shown, were yet fully sensible of the propriety of making both Manual organs to consist of the same number of keys; unless, indeed, as was sometimes the case, particularly in their very small instruments, one was only designed as a Solo or Echo organ, and not calculated for use in choral accompaniments. A few remarkable exceptions only to this rule are known to exist. In the generality of instruments built during the latter part of the seventeenth, throughout the eighteenth, and even at the commencement of the present century, we constantly find the Second Manual (Choir) of equal range with the First, or Great.

912. No doubt the Second Manual organ is in the present day sometimes made shorter than the requisite compass, through lack of funds; and, when such imperfectness is really the work of necessity, nothing can be said against it. That, however, is a separate question. When there are funds sufficient to pay for a GG Great organ and a tenor c Swell, there *must* be sufficient also to procure a Second Manual organ of nearly, if not quite, perfect compass, if the expenditure be so directed; so that the above plea is not admissible under such circumstances, since the lessened range of that department can then no longer be attributed to the smallness of the grant, but to the mode of its outlay.

913. The Swell being thus limited in its compass, some substitute is usually devised to supply the place of the omitted octave. The most usual expedients are to extend the Second *Manual* downwards to the same range as the First or Great organ, and make the continuation keys communicate either with the Pedal pipes or with the bass keys of the Great organ. It is only necessary, however, to advert to the derivation of the terms Manual and Pedal ("manus," a *hand*, and "pes," the *foot*), when the inaccuracy of bringing on to a *Manual* certain pipes designed exclusively for the use of the *feet*, and distinctly designated "Pedal" pipes, will become apparent. Besides, the Pedal pipes are the most ponderous-toned pipes in an organ, and, therefore, as a bass to the Manual, designed for *soft* accompaniments, are singularly inappropriate. Again, in many examples where there are "Double" Pedal pipes, instead of there being an interval of a semitone only between the unison sound of the last key acting on the Swell and the first one on the Pedal pipes, the two sounds are separated by an interval of a minor ninth; so that not only is the sound of the borrowed bass opposed to its newly applied purpose in the several respects of character, strength, and quality of tone, but in pitch it is of "16 feet;" whereas, for the Manual, the 8-feet pitch is most required.

914. Neither does the bass octave of the loud or Great organ form a satisfactory continuation to the soft or Swell organ, for the reason that, if the same combination be drawn on both Manuals, the strength of the bass (Great organ) will be too strong to match well with the remainder (Swell); or if, to obviate this, fewer stops be drawn on the Great organ, there will exist but slight affinity between the tone-character of the bass and the other parts. As before observed, if such arrangements as these arise from unavoidable causes, it is one matter; but if they are purely voluntary, as they must of

necessity be when they appear in conjunction with a GG Great organ, it is quite another.

915. The next point to be illustrated is the extent to which "long octaves" limit the specification of the different departments of an organ.

916. A good average specimen of a GG Great organ contains the following ten stops; viz.:—

1. Open Diapason.
2. Open Diapason.
3. Stopped Diapason.
4. Principal.
5. Twelfth.
6. Fifteenth,
7. Sesquialtera—III. ranks.
8. Mixture. II. ranks.
9. Trumpet.
10. Clarion.

917. By confining the above ten-stop Great organ to the CC compass, instead of extending it down to GG, the sum so saved would nearly, if not quite, defray the cost of the following stops; viz.:—

1. Double Stopped Diapason 16 feet tone.
2. Open Diapason . . . . 8 feet.
3. Open Diapason . . . . 8 feet.
4. Stopped Diapason . . . 8 feet tone.
5. Dulciana to Tenor c . . . 8 feet.
6. Stopped Fifth . . . . . $5\frac{1}{3}$ feet tone.
7. Principal . . . . . 4 feet.
8. Flute . . . . . 4 feet.
9. Twelfth . . . . $2\frac{2}{3}$ feet.
10. Fifteenth . . . . 2 feet.
11. Piccolo . . . . 2 feet.
12. Sesquialtera . . . IV. ranks.
13. Mixture . . . . III. ranks.
14. Trumpet . . . . 8 feet.
15. Clarion . . . . 4 feet.

That is to say, the number of pipes to most of the keys could be increased from thirteen to twenty; the range of deep sounds extended downwards to the extent of seven semitones; and the capabilities of the department for varied combination nearly doubled.

918. Or, supposing the sum saved were expended on the improvement of an originally contemplated tenor c Swell, containing the following six stops; viz.:—

1. Double Stopped Diapason.
2. Open Diapason.
3. Stopped Diapason.
4. Principal.
5. Trumpet.
6. Hautboy.

919. Not only could its specification be made to take the following improved form:—

1. Double Stopped Diapason 16 feet tone.
2. Open Diapason . . . . 8 feet.
3. Stopped Diapason . . . 8 feet tone.
4. Principal . . . . . 4 feet.
5. Fifteenth . . . . . 2 feet.
6. Mixture . . . . III. ranks.
7. Trumpet . . . . 8 feet.
8. Hautboy . . . . 8 feet.

but its compass could be extended downwards to at least Gamut G. That is to say, besides increasing the number of pipes to each key from six to ten, about half of the 8-feet octave could be added to the Swell Manual organ, which would be far more useful than half of the 16-feet octave to the Great Manual organ.

920. Or again, if the amount saved as above were to be laid out in getting rid of the ordinary "Pedal pipes" of a single octave only in compass—in which the unison and double pitches are so strangely mixed together—and

providing something more intelligible in their stead, the following stops could be secured :—

PEDAL ORGAN, COMPASS CCC TO TENOR D.

1. Open Diapason . . .	wood . . .	16 feet.
2. Stopped Diapason . .	wood . . .	16 feet tone.
3. Trombone	wood . . .	16 feet.

921. The questions that here suggest themselves are, first, whether the principle of organ-construction that *necessitates* the confusing of the Manual organ with the Pedal organ, and the Pedal organ with the Manual—making the one too long and the other too short—each rendered dependent on the other, while neither of them are in themselves complete, nor even capable of forming a satisfactory whole when united,—whether such a system should be perpetuated, in preference to the other principle, which has for its foundation the requirements expected of each department, and which, from its well-tested merits, has become the standard principle of nearly all other countries.

922. Or, secondly, if either of the three modifications just suggested on the original specification were to be followed, whether there would not result a much more satisfactory instrument?

923. It should be remarked that the *shortest* and *least expensive* of the various long octave Manual organs was selected wherewith to draw the foregoing parallel specifications. Had a longer compass been chosen, a still more surprising difference would have resulted; which would also have been the case even with the same compass, had two Manual organs been taken into account instead of one; or even one Manual organ, but having more stops.

Other views in favour of GG Manuals, and against CC, considered.

924. There are other grounds yet to be noticed, on which the desire for the perpetuation of elongated Manuals is founded.

925. It is urged—(1) that the introduction of the extra keys offers scope for the production of many fine effects; (2) that their presence is absolutely essential to serve as Pedal tones; and (3) that shortening the compass is going backwards instead of forwards.

926. That *sounds* below CC on the Manual are of the greatest use, and capable of most impressive results, has already been admitted, and is, indeed, self-evident. What is maintained is, that the desirability for their introduction does not call for a *lengthening of the key-board.*

927. When, for example, such sounds are required, it is very easy to draw the 16-feet stop alone, when they will be obtained not only to GG, but seven semitones lower. For this method of using the organ we have the authority of the greatest organist and organ composer that ever lived. Sebastian Bach not only played, but actually wrote some of his music to be executed with the left hand on a 16-feet stop only; by which means he drew from his instrument the practical effect of a CCC Manual, without overturning the theory of organ-building to obtain it. (See translation of Forkel's *Life of Bach*, page 86.)

928. No rules, or specific directions, setting forth the manner of using the extra keys of a GG organ with the hand, with fine effect, have ever appeared in print; and music for the organ, of what kind soever, offers little or no assistance on the subject; but, on the contrary, generally discountenances them. So that all is left to chance;—one has to *invent* a mode of using them, if they are to be *touched* at all;—and it is but a natural consequence that the attempts should, in different cases, be attended with various degrees of success. That the

Manual keys below CC are seldom made use of with the *hands* when they are introduced is clearly evinced by the comparatively *perfect* state in which those keys are *invariably* found, when most of the others are so much worn as to require renewal.

929. But whatever may be the effects attendant on the lengthening of the Manuals, if they be placed in juxtaposition with the decrease sustained in the number of the stops ; the loss of the numerous soft combinations that could have been made with the aid of those stops for accompanimental purposes ; and the impossibility of playing the best music even *correctly*, still less with adequate effect ; it will then be seen what sacrifices must be made to secure the presence of five semitones—the advantages of which, when they are obtained, is very generally questioned.

930. The next position, "that the presence of the extra notes on the Manual is essential, that they may serve as Pedal tones," offers anything rather than assistance to the principle of organ-construction it is intended to support. The anomaly of attaching to the *Manual* keys pipes that are expressly adapted for the *feet* has already been pointed out. The above plea is in favour of placing certain keys and tones on the *Manual*, which are conceded to be chiefly for the use of the *Pedals*. This creates a fresh discrepancy, and one that assumes a more prominent form, when it is considered for what purpose the extra tones are said to be introduced, and how far it is possible they can effect the end desired. If the Manual unison stops are required to serve as substitutes for the Pedal Diapason, they should descend as far as those Diapasons, namely, to CCC ; if as Octave stops, only to CC. The GG range is 7 semitones too short for the one purpose, and 5 too long for the other ; therefore the peculiar unfitness of the notes in question, from BB to GG, for rendering the assistance sought, in a correct and intelligible manner, becomes obvious.

931. In suggesting the adoption of the CC compass for the Manual, it must not be concluded that the notes below CC are not required *anywhere*, but simply that they are not required on that clavier as *Manual* notes. This leads to the third objection, that "shortening the compass is going backwards instead of forwards." This appears, at first, to be a well-grounded objection ; yet, in reality, it admits of a ready reply. The great question is not which is the *longest*, but which is the *most correct*, complete, convenient, compact, and economical compass. These questions have already been once considered, but they may be further illustrated by a return to our former parallel. Supposing a fifth and sixth strings to have been added to a violin, and, no legitimate use being found for them, they were taken off again ; the violin would not, on that account, become a less perfect instrument ;—there would be no "going backwards." Or, to draw the parallel more closely, if, to supply the two extra strings for the violin, two had been abstracted from the violoncello ; and it was afterwards desired that *both* should be rendered efficient ; there could be no question as to the propriety of reducing the former and increasing the latter to the proper and precise dimensions. This latter comparison is the more exact one to draw ; for the essential lowest octave of the swell, or the equally essential upper octave of the pedal organ have been but too often omitted, where the one or the other might have been introduced but for the unessential notes from BB to GG on the Great organ. It is believed there could be but one opinion as to the most correct course to pursue in regard to the stringed instruments ; and it would seem surprising there should be a second one against an equally consistent proportioning of the different departments of an organ.

932. It may be mentioned, by the way, that although the "viols" of former times had *six* strings, and the modern violins had but *four*, yet the latter have

always ranked as the *more perfect* instruments; while the advancement in the composition of music for string instruments, as well as of the playing on them, dates from the time of the general adoption of the instrument having *fewer* strings. The parallel holds good in every respect in regard to organs and organ playing in England.

933. The advocates for the long and for the short Manuals appear to be agreed on one very important point, namely, that the 16-feet range is the most correct one for as many of the organ *stops* as possible; the point of difference between them being as to where the large pipes should be planted, whether on the Manuals or on the Pedal.

934. In Germany, also, the CCC or 16-feet range is viewed as the most correct one for the organ *stops*, even more generally so than in England, but not for the organ *Manuals*. The *Pedal* is justly considered as the only proper place for their *bass*. This is conclusively shown in German specifications, where may frequently be seen disposed to a "Principal 8 feet" on the Manual a "Principal *bass* 16 feet" on the Pedal; to the "Octave 4 feet" on the Manual, an "Octave *bass* 8 feet" on the Pedal; to the "Flöte 4 feet" on the Manual, a "Flöte *bass* 8 feet" on the Pedal; to a "Quint $5\frac{1}{3}$ feet" on the Manual, a "Quinten *bass* of $10\frac{2}{3}$ feet" on the Pedal; and so on. A reference to the German specifications in the Appendix—taken either from German organ books or copied from the stop labels themselves—will fully illustrate this fact.

How the CC Manual compass was first exceeded.

935. The question here suggests itself how the CC compass ever came to be exceeded. The Manual range of the organs built immediately after the Restoration generally consisted of four octaves, from CC to c^3 in alt. (See Dr. Burney's article on the organ before referred to.) The Double Diapason at that time was scarcely known in this country, and was certainly not appreciated; the Pedal organ was entirely unknown; so that the English instruments of the date in question lacked those deep and sonorous tones which render an organ so peculiarly well adapted to its place in the church, and so superior to all other instruments for religious purposes. In proceeding to supply the existing deficiencies, without regarding either of the two systematic courses that were open for adoption, the third and only remaining mode of doing so was by extending the Manual downwards. Two notes were therefore added; one, sounding AA, placed on the CC sharp key; and the other, giving GG, on an additional key placed next beyond the CC one. A Manual of this kind is now called a "short octave" Manual, to distinguish it from the still longer ones that are to be met with. The result of this experiment being favourable *as to the effect*, the intermediate semitones from CC to GG were applied (excepting, perhaps, the GG sharp); and thus the GG long octave Manual organ was formed. Further extensions were subsequently made; first to FFF, then to CCC. It is now, however, admitted by the great majority of English organists that these added keys do not so properly belong to the Manual as to the Pedal; and that no sufficient grounds exist for introducing them as adjuncts to the former-mentioned departments in new work. It is not considered a sufficient reason for so doing, that the Manuals were made to GG in our fathers' time. Besides, if the key at which the Manual ought to stop is still to be passed—if the rules which should keep its compass within proper bounds are to be disregarded—there then exists nothing to prevent the introduction of a GGG or even a CCCC Manual, if individual taste should desire it. Such an extension would be but carrying out, to the extent of a second octave, the

elongating principle, which many would advocate to the extent of one octave, and which, moreover, would be equally justifiable on the same ground of individual fancy.

936. That the CC is the only true Manual compass would not then seem to be so much a matter of individual opinion (as must be the supposition on behalf of any other), as a self-manifesting fact—all church music clearly showing it to be so. That it is also the only one that facilitates the perfecting of the range and proportionate development of the other departments, by avoiding an undue outlay on the chief Manual organ, is also beyond a doubt. Under all these circumstances, independently of others about to be mentioned, the CC compass is the only one that can be suggested with confidence for adoption as the best for the Manuals of new organs.

The confusion in the size of the stops caused by their elongation.

937. But there is a disadvantage in lengthening out the Manual stops that has not as yet been hinted at, and one, moreover, that seems to be always overlooked by the promoters of long Manuals, namely, the confusion into which such elongation throws the question of the standard length and the literal pitch of the stops. It must have been observed that in much organ music, to save specifying any particular stop that the instrument might or might not contain, the direction given is often simply an open one; as, for instance, "one 8-feet stop," meaning, of course, thereby, a unison stop. Now, by extending the compass of the stops downwards, their size is altered; and so great is the confusion caused in consequence, that many of the lengthened stops on a GG, FFF, or CCC organ are made to assume a size identical with that of certain other stops, correctly ranged, to which they are quite opposed, either in nature and method of usage, or both, and which ambiguity is eminently calculated to throw those who are desirous of identifying the size and pitch with the use of the stops into the greatest doubt and perplexity. For example, an Open Diapason would be of 8-feet length on a CC Manual; on a FFF Manual the *Quint* would be the stop of that size; and, on one of the CCC compass, the *Principal*. If, therefore, an 8-feet stop were really to be drawn as directed, it would in the first case produce the right effect, but in the second would sound the music a fifth higher than written; and in the third the octave above. Again, in the instance of a GG organ, the Diapason and Principal ($10\frac{2}{3}$ and $5\frac{1}{3}$ feet), which should be freely available for the majority of combinations, and understood to be so, are, from their altered size, made to be identical in measurement with the *Quints* of better arranged organs; while the *Twelfth* and *Larigot* of a FFF organ (4 and 2 feet), which require to be used with much care, are by the same process made to correspond in size with the *Principal* and *Fifteenth* of a CC organ, which are scarcely at all restricted in their use. In fact, the sizes of the Unison, Octave, and Mutation stops are mixed, crossed, and inextricably confused together.

938. But, it might be suggested, if the confusion of lengths could somehow be got over (which of course it cannot), and the Manuals were to be extended down to CCC, whether then there would not result a satisfactory substitute for a proper Pedal organ, and one, moreover, that would offer great conveniences for the purpose of duet-playing. In one sense it would, but at the same time new difficulties would be created. What is required of an efficient Pedal organ is not simply a bass to the Great Manual stops, neither more nor less, but a Pedal bass to *as many* of the leading stops of *all* the Manuals as circumstances will permit, with the addition of such others as will stamp that department with a character of individuality. All these ends can never be attained by extending the compass of the Great organ, even to CCC.

939. And with respect to the conveniences for duet-playing, a principle of organ-building, that takes two performers to produce the effect that one could manage under proper circumstances, can hardly be said to be an advantageous one.

940. Again, if the Manual unison stops be increased to the 16-feet size, the Doubles will become 32; and, 32 being then the unison size for the Pedal, the Doubles will be 64 feet in length. The full development of a long Manual organ would demand the introduction of pipes nearly the height and bulk of factory chimneys, which would be destitute of definite tone when made.

941. In suggesting the adoption of the CC compass for the Manual, it will not of course be supposed that discontinuing the Manuals at that key will, alone and of itself, render an organ a better and more perfect instrument. It is nothing more than one necessary step towards a successful issue—a means to one end. Two of the most prominent faults of the long Manual systems are, they allot *too much* to certain Manuals, and *too little* to the Pedal, *both* of which faults require correcting. But if the 16-feet octave, or even a portion of it, be omitted from the Manual, and *nothing* be added to the Pedal by way of compensation, then the organ is left practically less efficient than it was before, in spite of the theoretical corrections. This is because the "bass" of the stops, instead of being simply transferred from the Manual to the Pedal, is omitted altogether, giving strong ground to justify the opinion of the promoters of the long Manual systems, that "shortening the Manual compass is going backwards." The *minimum* number of "Pedal basses" which a CC organ should have is *one third* as many as there are stops on the Great organ. The *maximum* number is one-third as many Pedal basses as there are stops in the entire Manual organs. Below the former proportion the Pedal stops are never reduced in Continental organs of pretension. (See Foreign Specifications, in the Appendix; also the works of Töpfer, Kützing, Seidel, Schlimbach, &c.) These observations, however, are not intended to qualify in the slightest manner the ample proofs already adduced of the great superiority of the CC organ, when consistently carried out. As compared with it the inferior and patchy Pedal effect of the GG organ is only equalled by a second unsuccessful imitation, also peculiar to long Manual organs, namely, that of mimicking the effect of a 16-feet stop by coupling the Choir organ to the Great in the octave below. Such expedients in co-existing organs that have only been partially remodelled are innocent enough, but they offer no satisfactory precedents for their adoption in new work.

The upward range of the Manuals.

942. With regard to the upward range of the Manuals, organ music very seldom ascends beyond c^3 in alt; while the psalm-tunes and chants, of course, do not reach anything like so high; but as the pipes to the keys above that c^3 are small, do not occupy much room, and cost but little, and moreover are very useful in a variety of ways—particularly where there are octave couplers—the Manuals are generally continued up to g^3, a^3, or even to c^4 in altissimo. The latter range is in some respects desirable for concert-room organs. The late Dr. Gauntlett was one of the earliest and most strenuous advocates for the CC organ, and for the concentration of a grand body and variety of tone on the Manuals.

CHAPTER XXXII.

OF THE PEDALS AND PEDAL ORGAN; THEIR INTRODUCTION INTO ENGLAND; AND CORRECT COMPASS.

943. AMONG the most important additions and improvements that have been made to the organ in modern times in England are to be classed the introduction of Pedals, and the establishment and subsequent development of the Pedal organ. These features, the importance and utility of which have for *centuries* been appreciated so justly on the Continent that a place has been assigned to them in every instrument of even moderate pretensions, are even now only just beginning to be adequately valued in this country. Yet, as Forkel observes, in his *Life of Bach*, page 99, "the Pedal is an essential part of the organ: by this alone it is exalted above all other instruments; for its magnificence, grandeur, and majesty depend upon it. Without the Pedal, this great instrument is no longer great; it approaches those little organs called in Germany *Positivs*, which are of no value in the eyes of competent judges."

944. A few particulars concerning the date, compass, and number of stops found in some early Continental Pedal organs may be of use, as showing at how early a date an independent Pedal was appreciated abroad.

NAME OF PLACE.	DATE.	NUMBER OF STOPS.	COMPASS.	NO. IN FOREIGN SPECIFICATIONS.
Amiens Cathedral	1429	7		14
Constance Cathedral	1518	8	CCC to Gamut G	115
Freiburg in Bresgau	1520	4	CCC to CC	37
St. Peter's, Hamburg, earlier than	1548	13, including 2 of 32 feet		69
Rouen	1630	8	CCC to tenor c	17
Lucerne Cathedral	1651	13, including 1 of 32 feet, and 5 of 16 feet	CCC to tenor c, short	114
St. Nicholas, Hamburg	1686	16, including 2 of 32 feet		68

945. It is not a little remarkable that Smith and Harris—the former of whom studied his art in Germany, and the latter in France—should never have made a Pedal organ, nor even Pedals, in England. What the cause of this striking omission could have been cannot now be positively ascertained; but we know that nearly every other real improvement in its turn met with the greatest opposition—as the introduction of Doubles, the establishment of equal temperament, the restoration of the CC compass, &c.—and probably the idea of introducing Pedals met with no better reception. Be this as it may, Pedals were not introduced into England till nearly the end of the last century. According to an autograph letter, written by the late Charles Wesley, and which was in the possession of the late Dr. Rimbault, the Savoy organ, by Snetzler, was the first that had a Pedal-board, without, however, any pipes, and which formed part of Snetzler's original work. Another account states that the organ in St. Matthew's Church, Friday Street, was the first to have Pedals; and, further, that they were of the two-octave CCC in compass, with a complete set of Stopped Diapason pipes of 16-feet tone attached; and were made, in 1790, under the direction of the late Rev. Mr. Latrobe. A third account is that the first Pedals made in England were those applied to the organ in Westminster Abbey by Avery; that they were a *ninth* in compass, GG to Gamut A, with an octave of unison Open Pedal-pipes attached; that they were such a novelty and

curiosity that people used to go from far and near to hear and see them; and that Dr. Benjamin Cook, who died in 1793, composed his fine Service in G for the opening of the instrument after receiving those additions.

946. Whichever of the preceding accounts is right or wrong, one fact is certain, namely, that the range of the Pedal-board and Pedal-organ, like that of the Manual and *its* organ, have in England been subject to great diversification. In seeking to form a governing opinion on this subject—*i.e.*, of the correct Pedal compass—the only sure course is to consider for what end the Pedal is introduced into the organ, and to take as a guide the result to which that consideration may direct us. The primary object, then, is to enable the organist to play the bass part of any church composition with his feet,* so that the necessity of his deserting the tenor and perhaps other inner parts may be obviated; to which, it is scarcely necessary to say, his left hand should be chiefly devoted.†

947. In Germany, Holland, &c., where the true principles of organ-construction and organ-playing are more generally understood and appreciated than was the case till lately in England, the question concerning the compass necessary for the Pedal-clavier and organ has long been set at rest; whereas in this country no attention at all commensurate with the importance of the subject was bestowed upon it, either by organists or organ-builders, until within the last few years; but the Pedals were generally made to accord with the incorrect GG Manuals.

948. But, as music had to be more or less altered and injured to suit such Pedals, a proper spirit of inquiry was awakened; the contents of the English and German sacred musical storehouses were diligently consulted; and from those unimpeachable sources a solution to the problem was obtained—"What is the proper compass for the Pedal?" The result of these examinations was the decision, that, to be competent for their purposes, a Pedal-clavier and organ should possess a range of from 27 to 30 keys and tones, commencing at CCC, and ascending to tenor e or f.

949. This CCC scale has accordingly been almost uniformly adopted in England during the last few years. Occasionally, however, the old GG, or some other long octave range, has been adhered to, consequently it will not be superfluous to set forth on what substantial grounds it is considered wholly unsuitable to the present advanced state of organ-playing in this country.

The insufficiency and incorrectness of GG Pedals for practical purposes.

950. The first disadvantage attendant upon a GG pedal-board is, that a very large proportion of the music written expressly for the church cannot be correctly played thereon. Even many of the little pieces in the instruction books of Rink, Hesse, &c., are beyond their capabilities. In fact, Pedals that have descended no lower than GG are precisely in the same imperfect state that a violoncello would be without its fourth string, that is, also descending only to G; and the straits to which a violoncellist would be reduced by such a curtailment of the proper compass of his instrument, may well be adduced to faithfully illustrate the difficulties which

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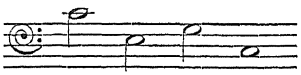
* Bach "produced with the Pedal, not only the lower notes, or those for which common organists use the little finger of the left hand, but he played a real bass melody with his feet."—Forkell's *Life of Bach*, page 33.

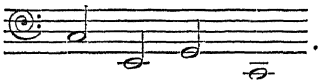
† The Tenor was formerly the Canto Fermo, Plain-Song, or principal part in a composition, and derived the name Tenor from the Latin word *tenuo, I hold;* because it held or sustained the air, point, substance, or meaning of the whole *Cantus;* and every part superadded to it was considered but as its auxiliary. In Tallis's Responses the Plain-Song is preserved in the tenor.

an organist who desires to play correctly has to contend with when performing on Pedals so incomplete in their downward range.

The wrong pitch in which GG Pedals execute on the Manual stops such passages as do come within their range.

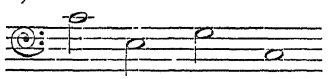
951. In such case, even passages which actually lie within their compass are not sounded in the right pitch on the Manual stops. It is the true nature of a Manual unison stop to produce sounds in *exact accordance* with the notes written; whether the keys be pressed down with the fingers, or drawn down by the Pedals; but this, usually, is what is *not* the case on GG organs. For instance, if some simple progression, such as the following,

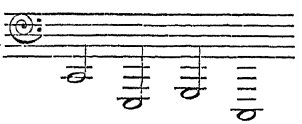


be played first on the Manual unison stops, and then repeated on the Pedals coupled thereto; instead of the same sounds being produced we have the following,  . In fact, we find this singular confusion of "size" and "sound" presented by a GG Open Diapason; while the stop itself is of 10⅔ feet standard length, its pitch will be of 8 feet if played with the hands, and of 16 if played with the feet.

The impossibility of satisfactorily uniting CCC Pipes to GG Pedals; and the false pitch in which the pipes sound when they are so united.

952. The second disadvantage attendant on a GG Pedalboard consists in the impossibility of satisfactorily attaching thereunto an octave of pipes having CCC for their lowest sound. The Pedals do not extend low enough to admit of the pipes being applied to the right keys; hence they are made to act on the only perfect C octave which the Pedals *do* present, namely, the octave above. But, in applying them in this manner, the pipes undergo transposition, which materially alters their nature. Instead of forming the *lowest* octave of a 16-feet stop, they then constitute the *upper* octave of a 32-feet stop, and produce a sound *two* octaves lower than the notation, thus :—

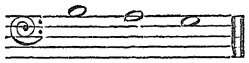
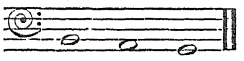
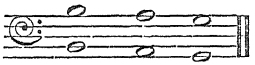
Written 

Sounded 

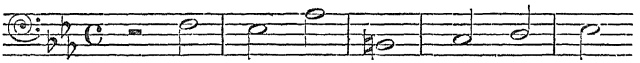
953. The incorrect Manuals suggest wrong Pedals; and the wrong Pedals necessitate a defective application of the "CCC Pedal pipes." The pipes being attached to the Pedals, in the manner just noticed, the remaining half-octave of Pedals (*i.e.*, the five treadles from BB down to GG) are either made to communicate with the same pipes as their octave above, or they are furnished with pipes in unison therewith; the result in either case being virtually the same. A "return" or "repeat" is caused in the series of Pedal sounds, which leads to this singular anomaly—that the pipe which produces the *lowest* sound is attached to one of the *middle* Pedals, while another that gives one of the *medium* sounds is made to act on the *lowest* Pedals.

The false readings which the CC Pedal pipes create.

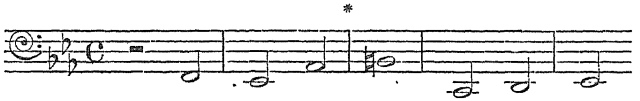
954. The third disadvantage attendant on a GG Pedalboard arises from the compulsory attachment of the CCC pipes to the wrong octave of Pedal keys, and the consequent "return" that takes place on the half-octave of keys below. By this "return

Pedal pipe system" the GG, G sharp, A, A sharp, and B Pedals are made to produce precisely the same sounds; so that whether the upper half-octave of Pedals be used  or, the lower,  or both together,  no contrast or relief of any kind can be gained. The consequence of this identity in the sound produced from both ends of the GG Pedal-board is, that such musical progressions as can be played on the treadles are altered, transposed, and reversed in their sounds, in the most remarkable manner; often producing effects of the most startling and grotesque description. A few illustrations of this fact will now be given.

955. The first is taken from the well-known Chorus in Handel's *Messiah*. "And with His stripes." The subject, on its first entry in the bass, stands thus in the score :—

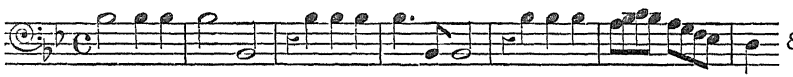


956. On " return Pedal pipes" it is given in the following form :—

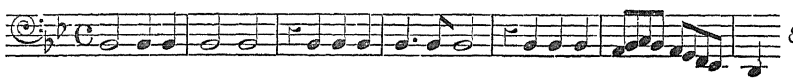


the subject being, in a musical sense, destroyed by the "return," marked by an asterisk, and a grammatical error of the worst description introduced.

957. The next illustration is the subject of the concluding Chorus in Mozart's *Litany* :—

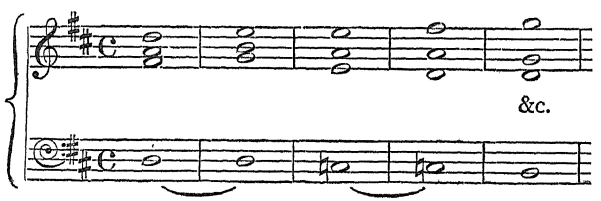


958. The above—one of the most dignified subjects ever written—is thus altered by the "return Pedal pipes" :—

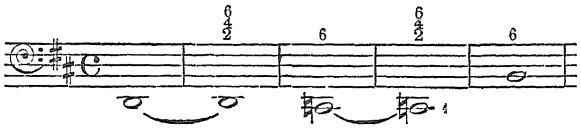


959. The reading conveyed of the first five bars of this subject then consists of a tame and meaningless reiteration of a single note.

960. The following few chords exhibit the progress of the harmony in the opening phrase of the introductory symphony to Handel's Coronation Anthem, *Zadok the Priest* :—

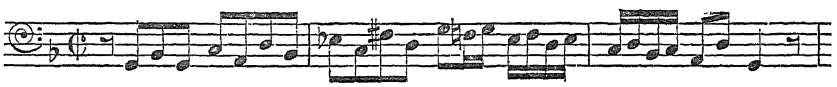


and the following notes show the very objectionable form the resolution of the seventh in the bass is made to take by the return Pedal pipes :—

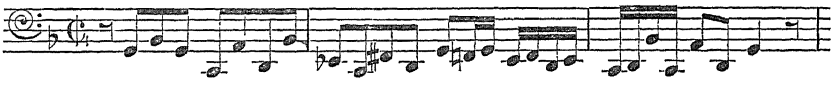


961. The foregoing selections are from works written for voices and instruments. The two following are subjects from strict organ compositions.

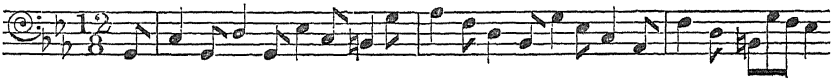
962. No. 1 is taken from Bach's well-known Fugue on the German Chorale, "*Wir glauben all' au einen Gott,*" and which stands thus in the composition itself :—



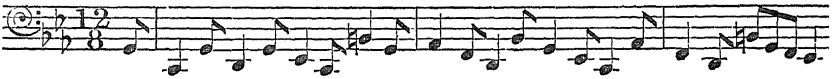
963. This is given out in the following form on the "return Pedal pipes":—



964. The next is from Mendelssohn's Fugue in C minor :—



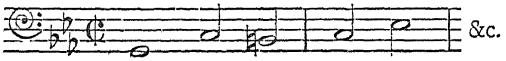
965. The Pedal pipes give the following version of the above :—



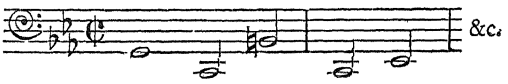
966. It would scarcely be possible to recognise either of the foregoing subjects when played on the Pedal pipes alone ; for the original order and nature of the intervals from note to note are so frequently altered, that but few vestiges of the original progression remain.

967. Here are two of the simplest subjects that are to be found in the whole range of our standard choral works for the Church :—

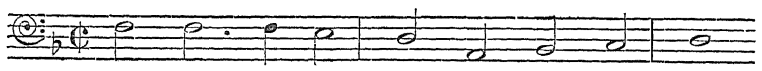
Opening subject of the Anthem, "I will exalt Thee," by Dr. Tye.



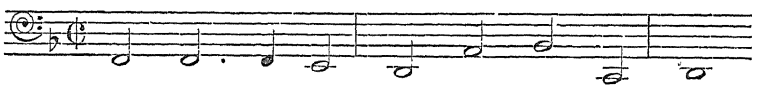
As given on a return Pedal organ :—



Opening subject of the Anthem, "Almighty and everlasting God," by Orlando Gibbons :—



Subject as given by a return Pedal organ :—



968. The list of examples of false reading rendered unavoidable by the principle of organ-construction already adverted to might be increased *ad infinitum;* but this must be needless. The above specimens will be sufficient to show how defective is the GG Pedal and "Double Pedal pipe" system. For concert-room organs it is absolutely worthless.

The introduction of "Double Pedal pipes" as the first Pedal stop not in accordance with the laws of organ-building.

969. But, independently of violating the rules of the Grammar of Music when they are being used, the "Double Pedal pipes," by their introduction as the first stop on the Pedal, involve a departure from the very rudiments of organ-building ; one of which is, that the unison stops of each Clavier, as being the most important, shall be *first* introduced. Others are (1) that the sound of the unison stops shall predominate ; and (2) that the first stops proposed for the Pedal shall be the bass to some of the Manual stops. That it must be impossible for the organ-builder to balance the tone of his instrument properly, if the most important Pedal stops—the 16-feet—are designed to be excluded, and another—the *Double*—which should be subservient, is to be introduced, is self-evident. Moreover, the specification itself presents great want of unity and clearness of design, when the "Double" is the only stop proposed for the Pedal, and yet is the stop that is omitted from perhaps all the Manuals, as is generally the case with GG organs.

970. It might be urged that the above important omission from the Pedal is very well supplied by coupling the Manuals thereto in such a manner as to obtain a 16-feet from the elongated stops of those departments, so far as their compass will permit. This, however, is not really the case ; for, instead of the scale of the single Pedal stop being so deduced from that of the borrowed unison as to secure the predominance of the tone of the latter, it is generally so much larger, and the power and density of its sound so much greater, that it cannot be reduced into proper proportion, even if the Diapasons of all three Manuals are coupled together and brought to bear against it.

971. In fact, after carefully considering what are the characteristics of a GG organ, with Pedals of the same compass and return Pedal pipes, and ascertaining its theoretical and practical defects, it scarcely becomes a subject of wonder that such a system (or rather no system) should be considered unworthy of perpetuation in the present day.

972. For, in the first place, it is as necessary to have the bass part of a composition played in an intelligible and correct manner as any other—more particularly as part-singing, and consequently part-playing, is now more often encouraged and appreciated in the English Church than it used to be ; and in the next, on an instrument so defective in the main points we have described, the greater part of the music of the church can either not be played at all, or without due effect ; as is but too well known to many an organist

whose misfortune it is to have so inconsistently arranged an organ whereon to play. Even the very name "Pedal pipes," as applied to the single half-stop on the Pedal of a GG organ, is devoid of definiteness and intelligibility. From such a name it cannot be gathered whether a stop, so called, sounds in unison with the Manual Diapasons, or whether it gives the octave below; or if it does neither the one nor the other in particular, but partly both. Neither can it be discovered whether its pipes are made of wood, or of metal, or whether they are Open or Stopped. Then of the Scale: the CCC pipes will in some instances be scarcely 10 inches deep; while in others it will be 20 inches —that is to say, there will be a greater difference than between the Dulciana and Open Diapason on the Manuals—yet there will be nothing whatever in the name or labelling to announce the difference. All these varieties of pitch, material, scale, and structure, are alike to be met with under the one indefinite term, "Pedal pipes."

The premature introduction of Double Pedal pipes often a hindrance to the introduction of more important Pedal stops.

973. Besides the defects above ennumerated, which they bring with them, the premature introduction of Double Pedal pipes is an injudicious step on other grounds. They are often the means of preventing the subsequent introduction of the more important unison Pedal stops, on account of the false impression which they convey of the "size" of the instrument of which they form a part. Instances might be cited, where an organist has represented to the authorities the imperfect state of his instrument; and has been told, in reply, that the organ is "too large" or "too loud" already; and this, too, when there has been but half a Swell, no Choir organ, and no Open Diapason, Stopped Diapason, &c., on the Pedal. Nor is such an answer made without some justification, although founded on a serious misconception. Those who have had neither the requisite leisure, nor opportunity to make themselves acquainted with the technical details and practical working of an organ, can only speak of the instrument from the effect which it produces on them in the church; and an octave of Pedal *pipes* (in a small organ), sounding *two* octaves below the corresponding octave of the bass voice, of a larger scale than those forming any other stop in the organ, and often supplied with a wind of extra strength, are just the very things to betray one who so forms his judgment into a wrong conclusion. Their tone, standing apart from the remainder of the instrument, as it must do under such circumstances, arrests the attention of the auditor; who, erroneously taking that as a sample of the sound of all Pedal stops, feels opposed to the introduction of the latter. It may seem paradoxical to those who are not sufficiently masters of the subject to be aware of its perfect truth, that an organ will possess more adequate means for being played *soft*, if the *one* octave of Pedal *pipes* be omitted, and some *three or four complete* Pedal *stops* be introduced; but such is nevertheless the fact. It is constantly the case in accompanying church music that a soft Pedal unison bass (that is, one of 16-feet pitch) is the only appropriate bass, while one of a heavier and deeper tone is quite opposed to the purpose; yet when, instead of some of these most important Pedal stops, there are only the "Double Pedal pipes" at command, the organist has no alternative but either to use those, in spite of their manifest inappropriateness, or none at all; and with the certain prospect of missing the true effect, do what he may, and perhaps of being held responsible afterwards for the result. What has been here advanced in relation to church organs applies with even greater force to concert-hall organs.

The arrangements of a C C organ contrast favourably with those of GG compass.

974. How strongly do the simple, systematic, and perfect arrangements of the Pedal of a genuine CC organ contrast with the complicated, faulty, and incomplete attributes of the GG plan, many of the particulars of which have just been detailed! For instance, on a correctly planned CC organ, the bass part of any piece of church music can be executed on the Pedals in all its integrity, let the instrument be ever so small. In the next place, music that is played thereon, with the Manuals coupled thereto, is not only sounded in the *correct pitch*, but is also given in *octaves*, consisting of the actual sounds represented by the notation, with the addition of *the octave below*, as would be the case in duet-playing on a CCC Manual organ. The most skilful left-hand would fail to play passages in octaves on a long Manual key-board, which can be executed with ease on a properly arranged CC organ. The *Manual* unison stops (8 feet) give the various progressions as they stand (just as bass voices or violoncellos would), while the *Pedal* unison stops (16 feet) give it as faithfully in the octave below; that is, in the pitch corresponding with that of the double basses;—so happily does an artistically planned organ facilitate, and render comparatively easy, the perfect execution of music of the highest and most difficult class.

975. It should be the aim, then, of those to whom is entrusted the task of designing an organ (if it really be desired that the instrument shall be as applicable and adequate to all its purposes as circumstances will permit, and be worthy of recognition as a work of art when completed), to eschew all plans that involve the violation of those rules and principles of which every organ-builder and organist is naturally supposed to be an upholder. All attempts to produce an artistic instrument will prove futile, unless the stunted GG Pedal-board and the imperfect and defective 32-feet stop be given up; and, in their lieu, a CCC set of Pedals, and at least one intelligible stop of 16-feet pitch, be substituted. In organs, even of the most diminutive kind, this is quite attainable. A Covered stop of that size of tone might, in extreme cases, be disposed on the Pedals; in moderate-sized organs, two or three 16-feet stops should be introduced. In instruments of larger dimensions a 32-feet *sounding* stop may be added; and in those of the first magnitude (*and in those* ONLY) should a 32-feet Open stop appear. The 32-feet stop, therefore, is one of the *last*, instead of the *very first*, to be proposed. The rules which regulate the admission of these and smaller Pedal stops, form a subject for separate consideration.

976. It need only be added here that the CC Manual key should be capable of being united to the CCC Pedal; the tenor c to the CC Pedal; and the middle c^1 key to the tenor c Pedal. The intermediate Manual notes would of course be attached to the respectively positioned Pedals.* Thus would be secured the presence and union of the 8 and 16 feet scales, even in an instrument of the most prescribed limits.

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* In adding C Pedals to a long octave Manual organ, it would be necessary, in order to prevent the notes below CC from becoming useless, to have *two* Pedal-couplers; one of the kind above recommended, and another to unite the GG Manual note to the GG Pedal, and so on. In many existing cases, where there are CCC Pedals and GG Manuals, the Pedals from CCC to FFF take down the Manual keys from CC to FF, and then the GG Pedal draws down GG on the Manual. This creates a *second* return.

CHAPTER XXXIII.

THE SITUATION FOR THE ORGAN.

977. The next subject for consideration—the situation for the organ—is of no less importance to those already discussed; since on it depends, in a great degree, the best effect of the instrument when finished. So great an influence, indeed, does the position exercise on the power and quality of an organ, that an inferior instrument favourably situated will sound better than a superior one that is unfortunately placed; and a weak-toned instrument in a good position will sound louder than a fuller-toned one in an unfavourable situation.

Acoustical facts to be consulted.

978. Before entering upon the inquiry as to which are good situations and which are not, it may not be unimportant to mention certain facts connected with the production and propagation, the absorption and weakening, the interception and reflection of sound; as a recollection of these will materially assist in illustrating the relative excellence, or otherwise, of the several sites that will have to be brought under notice.

How sound is produced and propagated.

979. First, then, as to the production and propagation of sound. "When bodies are brought into sudden contact," says the author of the volume entitled *The Art of Improving the Voice and Ear*, "or a single body is made to vibrate or expand suddenly, it must displace a quantity of the surrounding air. The air which is thus displaced in its turn displaces that portion of air which is next to it or beyond it on every side, above and below, before and behind, on the right and on the left. This displaced portion of air displaces again what is beyond it, and so on, in a manner similar to the circles of water which arise from throwing a stone into a pond. In the case of sound, however, the waves are not in *superficial* circles, but in *spheres*, like the coats of an onion. Sound, then, travelling, as it does, in all directions, this circumstance clearly accounts for the excellent musical effect which an organ produces that occupies a *central* position in a building; as, for instance, the choir screen of a cathedral, or other large cruciform church."

How brief sounds disperse.

980. A sound that is only an instant in duration and not continuous does not spread like a flood of water, pervading every part over which it passes; but, like a ripple made in a lake, which leaves in repose the part that it has quitted. This may be ascertained by striking a full staccato chord on a cathedral organ that occupies a central position, when the sound will be distinctly perceived retiring from the instrument to the remotest parts of the building, gradually lessening in power, and ultimately dying away.

How sustained sounds more completely occupy space.

981. A continuous sound, on the contrary, pervades the entire space through which it has travelled; because fresh sound-waves are constantly being engendered, which successively

occupy the space the preceding ones have left. This is the reason that the first sound of a sustained chord on a cathedral organ is *not* heard receding. The greater strength of the sound-waves nearer the instrument, from being less spent by divergence, prevents the original sound being heard. On raising the hands, however, from the keys, the sound will again be heard fading away.

The distribution of a sound that cannot travel backwards.

982. A sound that is produced in such a situation that it cannot travel backwards, on account of there being a large reflecting surface to check its progress in that direction, as in the example of an organ placed at the west end of a church, spreads somewhat after the manner of the rays of light through the bull's-eye of a lantern. It travels forwards and sideways, upwards and downwards, and spreads as it proceeds. It is also reflected forwards by the surface behind; and derives some accession of strength from being so reflected. Sound, however, being greatly more reflexible than light, it spreads more rapidly, makes its way into recesses, round columns, and passes great walls or corners of buildings, where the solid interpositions would, in the example of light, only cast shadows.

983. An illustration of the fact of sound spreading as it proceeds may easily be found in a galleried church having the organ at the west end. The tone of the instrument is heard the most completely, *not* by stationing one's self immediately inside the door, at the side of the organ, leading into one of those appendages; but by traversing the gallery some little distance. In a similar manner, an illustration of the fact of sound descending as it progresses, is given in the circumstance of an auditor in the nave having to place himself at some *distance* from the instrument to hear it to the greatest advantage; and in his having to *increase* that distance in proportion to the *elevation* of the organ above the ground.

984. The extent to which the sound of a west-end organ is strengthened, by reflection from the surface behind, does not meet with a familiar illustration in a church that has the instrument so situated; but, in those cathedrals wherein the organ occupies a central position, a good example is presented by the effect of the "Choir organ in front;" the tone of which sounds strong in the choir, into which part it is directly reflected by the Great organ case behind; but which sounds weak outside the choir, on account of the Great organ case standing between the Choir organ and the auditor, and, therefore, presenting an interposition to the tone travelling in that direction. The extent to which the Great organ case assists the tone of the Choir organ in its forward progress into the choir, and checks its backward course into the nave, are points that received distinct illustration in St. Paul's Cathedral in the year 1854, on the occasions of the Sunday Morning Service being celebrated in the choir of the church, and the afternoon under the dome. In the fore-mentioned part of the building the tone of the Choir organ, as far as the Principal, reflected as above, sounded louder, and afforded more support to the vocal choir, than did the same stops, with the Twelfth and Fifteenth added, impeded as above, when the singers sat outside the choir screen. Another proof, though of a negative kind, of the extent to which a sound is strengthened by reflection, is afforded by the circumstance of its being so much weakened by the removal of the reflecting surface from behind. An illustration of this fact was given at Westminster Abbey, when the Great organ was removed from the centre of the screen; which alteration, allowing more of the tone of the Choir organ to travel backwards into the nave, caused it to appear more "faded" in the choir.

Sound weakened by divergence.

985. As the circular waves on the surface of a piece of water become more faint as they proceed and diverge, so sound becomes weaker the farther it travels and the more it disperses. "Whenever," says Dr. Brewer, in his work on the *Phenomena of Sound*, "sound can diffuse itself freely round its centre of propagation, it loses in *intensity* what it gains in *extent*;" consequently, a sound that has travelled *twice* a certain distance will only be heard with *one-fourth* its original strength, the loudness not diminishing inversely as the distance increases, but inversely to the *square* of that distance. This is the case in the open air; but in a building—as a church or a concert-room—the walls and roof limit the extent of the divergence of the sound, and so prevent its fading away so rapidly. Moreover, after the sound has struck against them, and is checked by them, it is by them reflected back; and, if the original sound has ceased, the reflected sound forms an echo; but, if it continues, the latter mingles with the former, and enriches and strengthens it.

Echo.

986. When the return of the sound is perceptible to the ear, it is termed an echo. A certain time, however, must elapse between the production of the sound and its being reflected, or no echo will be perceived; and that time at least must be the twelfth part of a second, within which interval the ear is incapable of receiving separate impressions. The distance of the reflecting surface, therefore, must be at least forty-seven feet from the place whence the sound emanates to cause an echo.

Resonance.

987. But the strength and quality of a musical sound are much increased and improved by the reciprocation of bodies in the more immediate neighbourhood whence the first sound emanates. Thus the vibrations of a tuning-fork will, on the tip of the handle of the fork being placed on a table, acquire a marked accession of strength. This augmentation of sound is due to *resonance*. The sonorous vibrations created by the tuning-fork set the wood upon which it is placed in a similar state of citation; the simultaneous vibrations of which, being communicated to the superincumbent air, greatly increase the strength of the original sound. The front, back, sound-post, and all the air contained in the body of a double-bass or violin, in like manner contribute to produce the volume of tone elicited from the instrument, by vibrating in unison with the strings and with each other. If only the *strings* vibrated, the sound would be comparatively insignificant; but, when the entire body of the instrument is set in motion, the impulse is sufficient to produce sounds of considerable power.

988. A sound thus increased and enriched is capable of further augmentation from resonance, if it is produced under circumstances favourable to the extension of that influence. The tone of a double bass, for instance, is much increased in power by the instrument resting on a hollow platform—as the reciprocating floor of a concert-room orchestra. "The platform receives from the musical instrument a vibratory motion, imparts the same to the air between it and the floor of the building, and the whole combined gives a powerful impulse to the air in the concert-room." (Dr. Brewer, page 277.)

989. These several examples illustrate precisely the effect of resonance on the tone of an organ. The tone of an organ is much improved by the instrument being placed on a wooden floor; and it is still more beneficially affected when that floor is a raised one. The reasons are these. The sound-board acting somewhat after the manner of the belly of a violin; the frame-work

as the sound-post; and the *wooden* floor as the back; all are thrown into a state of greater or less vibration by the sounds, which in this case are produced by pipes and not strings.

990. The vibratory motion of portions of the frame-work is sometimes perceptible to the touch, even when a single stop only is being sounded on the sound-board above, as, for instance, the Stopped Diapason; while that of the floor is frequently felt by the feet, when all the stops are in full play.

991. The air between the sound-board and the ground is also set in motion, like that in the body of a violin; and sometimes its tremulousness is sufficiently great to cause the trackers to vibrate in their registers. The tone of a large pipe, again, is much strengthened by standing on a wooden floor, even as that of a double-bass is by resting on the platform of an orchestra. This is one of the reasons why organ-builders place their great Pedal Diapason pipes as near to, if not actually on the floor, whenever this arrangement is practicable.

992. The wooden portions of the case of an organ, again, are frequently of essential service in increasing the resonance. It has sometimes happened that a pipe that has produced but a weak sound has, when tried in its situation, and been assisted by the vibrations of the case, produced one of the finest notes in the instrument.

993. When the wooden floor on which an organ stands is a raised one, the platform, together with its supports, and also the free air about the whole, are all thrown into a state of vibration, to the augmentation and improvement of the sound; and when the heavy-toned bass pipes are being used, the vibrations of the flooring or platform are sometimes communicated to the wooden fittings of the church, or even to the very walls of the edifice.

994. Echo and resonance, therefore, each exercise great influence on the tone of an organ. Echo imparts to it that inexpressibly charming, etherial, lingering effect which is so perceptible in cathedrals and other large buildings that are comparatively free from absorbents, after the actual sound has ceased. Many buildings which do not produce a *perceptible* echo yet impart a certain buoyant, free effect to musical sounds produced within them, that is highly beneficial to the quality of their tone, as well as favourable to their distribution.

995. Resonance is the cause of the agreeable, pleasant, humming effect which is heard to come from within the organ itself. In low, broad, galleried buildings, where but little room has been allotted to the organ, and where the contents of the instrument have in consequence been so crowded together as to leave but little free space inside it, the resonance is much decreased: and an effect is frequently perceived as though the sound of the organ were struggling to develop and disperse itself, in spite of the impediments with which it is beset. The effect of an instrument so constructed and situated is frequently dead and *palpable*. Instead of the many different sounds which in an organ are concentrated on each key, mingling together, and producing the effect of one excellent whole, every "item" falls on the ear as a distinguishable separate and isolated sound.

Impediments to the equal distribution of sound.

996. The most common impediments to the equal dispersion of the tone of an organ occupying a west gallery are the lateral galleries. These catch the sound as it spreads, and prevent its descending into and pervading the aisles beneath so effectually as it would otherwise do.

Absorbents of sound.

997. The materials and fabrics common in churches that soften and deaden sound are wool, cloth, hair, tow, matting, &c. "Thes- -hut- -n-

a large quantity of air between their minute and detached parts, so that they cannot readily transmit an impulse." (Dr. Brewer.) Cushions, hassocks, curtains, people's dresses, and matting, therefore, are all absorbents of sound.

Church arrangements that are favourable to sound.

998. The exclusion of lateral galleries from modern churches, together with their baize linings; the introduction of low open seats, in place of high closed pews; the removal of hassocks in favour of kneeling-boards; and the substitution of Minton's tiles for matting up the avenues; these are all favourable steps towards the preservation of the acoustical properties of the building.

Absorbents sometimes introduced to subdue excessive echo.

999. While the influences of impediments and absorbents are, generally speaking, highly detrimental in their effect, there have been instances of the latter being made to serve a beneficial purpose; as when the echo in a building has been so great as to render sounds, whether of the voice or of music, confused and indistinct. At the Chapel Royal, Whitehall, the echo was found to be so excessive, a few years ago, after the building was restored, that the clothing of an assembled congregation was insufficient to check the remarkable prolongation of sound; and crimson cloth was therefore hung in festoons round the building, which, not presenting a sufficiently hard surface to throw off all the tone, but, on the contrary, a sufficiently soft one to absorb some of it, produced the desired effect.

Velocity of sound.

1000. The average rate at which sound travels in atmospheric air is 1,120 feet in a second of time; and high and low sounds, soft and loud sounds, all proceed with the same velocity. Thus the tones of the lightest treble voice will reach the extremities of an extensive building as rapidly as those of the heaviest bass voice; and the sounds of the most delicate Dulciana as quickly as the tone of the most ponderous Posaune. Were it otherwise, the acute and grave tones of voices, and the weak and strong-toned stops of an organ would be heard confusedly jarring after one another.

1001. But for the same reason that the ripple caused by dropping a small pebble gently into a smooth piece of water will not spread so far as those produced by casting a large stone into it, the sound-waves produced by a soft musical sound will not extend so far as those excited by a powerful one. Its precise strength depends, in the first instance, on the force of the shock that is imparted to the air; and which produces sound-waves of correspondingly decided character. The distance to which it will travel depends on the extent to which the sound-waves can spread without meeting with an obstruction. When there are no impediments, and but few absorbents in their course, the sound not only reaches farther, but mellows as it progresses; when they meet with many obstructions or absorbing circumstances, it not only does not reach so far, but its strength is lessened and its quality impoverished.

1002. The distance to which a sound will travel depends upon its intensity, density, and perhaps gravity. A dense sound will travel farther than an intense one, as is proved by the fact of the beat of the great drum of a military band playing in the open air being distinctly audible at a greater distance than the united sounds of the trombones and ophicleides. Grave sounds also appear to travel farther than acute ones. The Open Pedal Diapasons of an organ may be heard at a greater distance outside a church than the higher organ sounds; and the tone of the double-basses in an orchestra may be distinguished sooner than

the treble instruments, as you approach a concert-room. The "tenor" of a peal of bells is also frequently heard at a greater distance from a church, or at any rate more distinctly, than the other bells.

The apparent strength of a sound dependent on the position of the auditor, &c.

1003. The *apparent* strength or weakness of a sound will depend on the relative position of the sounding body and the auditor; that is to say, whether they be near to each other or far apart; and also, to a material extent, whether there be many absorbing substances between them. A sound of a given strength will sound louder at a greater distance, when the intermediate space is comparatively free, than it will at a less distance with impediments interposed; hence the fact, mentioned at the commencement of this chapter, of the tone of an inferior organ being improved, and of a better one being injured, by its position, the acoustic capacity of the church, and the nature of its fittings. If the auditor is stationed below the level of the sounding body, he will hear the sound as it diverges downwards; if he is on either side of it, he will hear it as it spreads; but if he is on the same level with it, and near to it, he will experience its full and direct force, at the same time that his clothing will present an absorbing impediment to its free progress; while, on the contrary, if he is stationed at a distance, and other persons intervene, the sound will reach him in a weakened and faded form.

1004. When the amount of absorbing substance in a church is needlessly increased, and the organ occupies a position unfavourable to the equal distribution of its tone, the instrument will sometimes sound "too loud" in some parts of the church, at the same time that it will appear "too soft" in others. This inequality of effect, however, is, under such circumstances, unavoidable.

Penetration of sound.

1005. Sound possesses the power of penetrating and passing through hard substances; hence the circumstance of the tone of an organ being heard so plainly outside a church. When an organ is placed in a chamber built out from a church, and is accompanied by other arrangements disadvantageous to the free dispersion of its tone, it will even be heard almost as distinctly outside the building as in it. Another illustration of the penetration of sound is presented by the swell of an organ, the tone of which is heard perfectly well, though in a sweetly subdued form, through the thick wooden box, when the shutters are perfectly closed.

1006. Having noticed such phenomena connected with sound as appeared to be necessary to illustrate our present subject, we may now proceed to consider the various situations occupied by church organs, as well as the merits of each.

The west end of a church as the situation for the organ.

1007. The most usual position assigned to the organ in Continental churches, for at least the last three hundred years, has been the west end.

Old examples of west-end organs in Continental churches.

1008. A few examples and dates may be cited, illustrative of this fact. The organ in Amiens Cathedral, which has a 16-feet front, and was completed in 1429, originally stood and still stands at the west end. The organ in Chartres Cathedral, built in 1513, was first erected over the great western doorway. In the Cathedral at Constance, in Switzerland, the organ at the west end was originally erected in that situation, in the year 1518, which date appears on the case of the

instrument. The organ at the west end of the nave of the cathedral at Freiburg, in Bresgau, was built in 1520. At Hamburg, the oldest organ in the town, previous to the conflagration of 1842, in St. Peter's Church, stood at the west end, and had a 32-feet front. It was not known when or by whom it was originally built; but the last two manuals—it had four—were made at Hartzogenbach, in Brabant, by Mister Nargenhof, in 1548, and sent to Hamburg by sea. This, M. Pfiffer, the organist to the church towards the latter part of the last century, informed Dr. Burney was upon record. Again, at Lübeck, in St. Mary's Church, the Great organ, which has lately been rebuilt, but originally made in 1518, is similarly situated. This instrument is a "hanging" organ, with a 32-feet front of tin; and the beams which support it are built into and project from the wall behind.

1009. There were three old west end organs standing a few years ago in churches at Liege. That in the church of St. Denis, which had the Choir organ in front, bore the date of 1589 carved on the case; the second, in St. Jaques', also with Choir in front, was built in 1600; and the third, in St. Anthony's Church, had the date of 1624 carved and gilt on the case.

The merits of the west end, as the situation for the organ, considered.

1010. In selecting the west end of the church as the situation for the organ, the ecclesiastics, architects, organ-builders, organists, or whosoever fixed on that position, no doubt gave it the preference for the same reasons which in old times led to the end of a baronial hall being selected as the site for the "Minstrels' Gallery;" and in after times the extremity of a concert-room being generally recognised as the best place for an orchestra;—namely, because the tone could travel "forwards, sideways, upwards, and downwards;" in fact, could be dispersed throughout the building more equally from that available situation than from any other.

1011. An orchestra so placed has the area of the entire length of the room before it, into which the sound, from the great concourse of instruments, can travel, and, in a united state, fall on the ear of the auditor. In the same manner an organ, similarly situated in a church, has the area of the entire length of the nave and chancel before it, into which the sound from the several pipes can travel, and, in a united and mellowed form, reach the ear of the clergy and congregation.

1012. The west end afforded sufficient space to admit of the organ being erected on an elevated platform or gallery—as a modern orchestra is elevated above the level of an audience—whereby the resonance was increased, and additional freedom also imparted to the tone.

1013. By elevating the instrument, the full force of its tone passed over, instead of overwhelming those nearest to it, into the open space before it, whence it was diffused throughout the edifice. A sound is distributed more equally from a raised position in *any* part of a church than from a low one; hence the necessity for a reading-desk, pulpit, and steps to the altar, to elevate the minister, so that his voice may travel to the remote parts of the building.

1014. The west end, at the same time that it admitted of the organ being sufficiently elevated, presented facilities for this being done, and yet plenty of space being left between the top of the instrument and the roof of the church, whereby the tone was still further and beneficially affected. Into this space the numerous pipes poured forth their separate sounds, which, there meeting and amalgamating, entered the church with united and mellowed effect.

1015. Had the organ, however, been placed too near the roof, its tone would have been partially "smothered" in effect, and the instrument itself exposed to

considerable injury from the excessive heat of the sun in summer, which might then often have been conducted into it through the roof, and from the cold and damp in winter. A certain amount of derangement from atmospheric change would at times be unavoidable, as explained in a former chapter; but such variations would have told with much greater severity, had the organ been placed close to the roof; where, in addition to its pipe-work being more frequently thrown out of tune by the excessive alterations of temperature, the mechanism would, by its exceeding dryness at some seasons and dampness at others, have been rendered more subject to sticking, swelling, warping, ciphering, and many other evils of a like kind, with which casualties subsequent organ-builders were compelled to become familiar when they had to erect instruments in "second galleries."

1016. The west end, again, generally admitted of more space being devoted to the organ, which obviated the necessity for crowding the mechanism and the pipe-work.

1017. When an organ-builder is "cramped for room" the mechanism has often to be crammed so closely together that, on the occurrence of some trifling fault, much additional derangement must be caused before the seat of the original failing can be arrived at. And the same with the pipe-work; but with the additional disadvantage that, when the pipes are "packed too closely together," there will sometimes arise a beating or a jarring, or a weakness or unsteadiness of speech, in some of the pipes that will defy correction.

1018. Another very important object attained by placing the organ at the west end of the church was this. An efficient organ was necessarily also a large one; and the larger the organ, the greater probability of its becoming an eyesore. By erecting it, however, at the west end, it would not be within sight of, but at the *back* of the congregation, and would only be visible to its members on their turning to leave the church.

1019. The reasons, musical, acoustical, and structural, in favour of the west end, as an eligible situation for the organ, therefore, were very great.

An architectural objection to the organ occupying the west end.

1020. *Architecturally* considered, however, it was frequently open to one great objection. Most churches had a west window; generally one of the most handsome in the building; to hide which would have been a serious sacrifice. Many organs were therefore made, so as still to occupy the west end for the sake of the musical effect, but so that the architectural feature should not be hidden, nor the light through it excluded from the church. Several instruments so constructed are mentioned by Dr. Burney in his tour through Germany and Italy, the particulars of which are here extracted:—

Examples of divided west end organs in Continental churches.

1021. "In the town of Courtray, the organ, at the collegiate church of *Notre Dame*, is disposed of in a very singular manner; it is placed in a gallery at the west end of the building; but in order to preserve the window, which was necessary to light the body of the church, the organ is divided in two parts, one of which is fixed on one side of the window, and one on the other; the bellows run under the window, and communicate with both parts of the instrument, which is a large one of sixteen feet, with pedals, and seems to have been but lately erected (1772). The keys are in the middle, under the window, but not to be seen below."

1022. "The organ at the Dominicans' Church, at Frankfort, has an arch

cut through it, to let the light into the church from the west window; it is in a handsome case, the ornaments over the arch are in good taste, and the side columns are well disposed. The keys are on the right hand *side* of the instrument, over which there is a small front; the compass is from C to C, the pedals have an octave below double C."

1023. "In the cathedral at Passau, which is a very beautiful modern building, of the Corinthian order, there is a very magnificent organ to look at. The case is finely carved and gilt, and the pipes are highly polished. It is divided into two columns of large pipes, one on each side, and has a complete little organ in the middle, which joins them together, and saves the west window. It is what builders call a 32-feet organ. The front pipes are of burnished tin."

1024. St. Michael's Church, Vienna. "This instrument has no front. The great pipes are placed, in an elegant manner, on each side of the gallery; and there is a box only in the middle, of about four feet square, for the keys and stops;—so that the west window is left quite open. The compass of the organ, in the Manuals, extends only from double E* in the bass to C in alt; but the Pedals of most German organs have an octave lower than the lowest note of the keys that are played by the hands, which is the case with this instrument. It has forty stops and three sets of keys, which, by a spring of communication, can be played all together."

1025. Prague. The organ in the church of St. Nicholas "is divided into two parts, placed one on each side the gallery; and the keys, with a *positif*, or small Choir organ, are in the middle, but placed so low as to leave the west window clear; instead of wood, the framework, pillars, base, and ornaments of this instrument, in front, are of white marble."

1026. To these examples may be added the organ at Weingarten, in Suabia, which is so constructed as to admit light into the church through six semi-circular-headed windows, ranged in two rows of three each. The organ at the Minoreten Church, at Cologne, is also pierced with several window-like openings, to admit light from the west window into the body of the building.

Smith and Harris's parish church organs usually placed at the west end.

1027. When Smith settled and Harris returned to England, towards the latter part of the seventeenth century, to take part in supplying our churches with new organs, in place of those that had been so needlessly destroyed, they followed the custom, usual in their own countries, of placing their organs at the west end of churches not of cruciform shape; but they at the same time erected them in that situation, whether there was a window there or not. No instances are known of a *divided* organ having been made by either of those artists, for the purpose of preserving an architectural beauty. The earliest English specimen of an organ constructed in this manner appears to have been that made by Green, for New College, Oxford. Many others have since been constructed in this way; one of the most successful in its treatment being that by Hill, in the church of the Immaculate Conception, Farm Street Mews.

Their cathedral organs usually placed on the choir screen.

1028. The cathedral organs built by Harris and Smith were usually placed on the Choir screen. This situation appears to have been selected for two reasons. The instruments they were

* The organ is really of CC compass, but having short octaves; which fact appears to have escaped the Doctor. (See Foreign Specifications.)

called upon to build for those spacious and venerable piles were scarcely a whit larger than those they made for ordinary parish churches; and it must, therefore, have been obvious that, if they were placed at the west end, the *firmness* of their tone would have been utterly spent before it could have reached the choir. They were accordingly erected some 150 or 200 feet nearer to the vocal choir, and generally in such a situation as a knowledge of acoustics prescribed as the best.

Harris's proposal for a grand west end organ in St. Paul's Cathedral.

1029. Renatus Harris, indeed, made a proposal in 1712, and, therefore, after the death of Smith, to erect an organ in St. Paul's Cathedral, "over the west door, at the entrance into the body of the church," which was to be such a one as "in art and magnificence should transcend any work of that kind ever before invented;" and in its construction it was intended to "apply the power of sounds in a manner more amazingly forcible than had, perhaps, before been known." (See Hawkins's *History of Music*, vol. iv., page 356; quoting the *Spectator*, No. 553, for December 3, 1712.) Is it possible, as this quotation would imply, that Harris had some partial acquaintance with the principle that Cavaillé-Coll has in our own times carried out with such fine effect in his Harmonic Flute-work, and Hill in his "Tuba" Reed-work? At any rate, to *equal* "any work before invented," Harris's must, in size, have been a 32-feet organ. But, whatever the details of his plan might have been, the plan itself was not accepted.

The erection of Father Smith's organ on the Choir screen of St. Paul's opposed.

1030. Father Smith had previously erected an organ on the Choir screen of St. Paul's; but whether it should occupy that position or not, had been a subject of warm contention between Sir Christopher Wren and the Dean and Chapter of the Cathedral.

1031. "Sir Christopher Wren," says the article in the *Musical Gazette*, from which we have before quoted, "wished the organ to be placed on one side of the Choir, as it was in the old Cathedral, that the whole extent and beauty of the building might be seen at one view; the Dean, on the contrary, wished to have it at the west end of the Choir; and Sir Christopher, after using every effort and argument to gain his point, was at last obliged to yield. Schmidt, according to his instructions, began the organ, and, when the pipes were finished, found that the case was not spacious enough to contain them all; and Sir Christopher, tender of his architectural proportions, would not consent to let the case be enlarged to receive them, declaring the beauty of the building to be already spoiled by the '—— box of whistles.' After all this contention, the architect, sorely against his will, was obliged to make an addition to the case. He not only had been niggardly in regard to the depth of it, where another foot would have been of no consequence whatever, but also in the height; for, when Schmidt came to put in the large Open Diapason pipes in the two side flats, they appeared through the top nearly a foot in length, and spoiled the appearance entirely. Schmidt now entertained hopes of having a new case; but Sir Christopher, who before would not suffer any ornaments on the top, was now obliged to add several feet, or else alter the case, which vexed him exceedingly. These ornaments consist of angels, with trumpets, standing at the side of a small altar. The colour of the wood that these are made of being lighter than the organ-case, the addition is soon discoverable."

1032. In this struggle Smith evidently viewed the question *musically*, while Sir Christopher Wren considered it *architecturally;* and both had reason on

their side. Sir Christopher was, of course, correct in asserting that an organ in the centre would prevent the whole extent of the building being seen at one view; but then the objection applied with equal force against the Choir screen, to defend which and condemn the organ involved a manifest inconsistency.

1033. The result of the contention was, as we have seen, that

"Music won the cause;"

and the arrangements just detailed were uniformly followed in cathedral and other churches, from the time of Smith and Harris, down to within the last few years.

The comparative merits of the several side situations considered.

1034. In recent times the west end of a parish church, as the position for the organ, has been strongly objected to, particularly where there is a choir; and there is no doubt that a much better musical effect results from the choir and organ being near to each other, as a more united effect is produced in a concert-room by the band and singers being together.

1035. Next to the west end, the best place for the organ, as indicated by the laws regarding the propagation of sound, will be some elevated position, having space above, and both sides free. These conditions point to the *side* of the church; and in every instance, where all or most of them have been complied with, a very good effect has resulted.

1036. The organ in the church of St. Mary Magdalene, St. Pancras, built by Gray and Davison, may be cited as a successful example of an instrument so placed. It is supported on stone brackets, about eight feet above the ground; has good head room; is entirely free at one side, and has a reflector immediately behind, in the south wall of the aisle.

1037. In some instances, where sufficient room could not conveniently be found in the church itself for the organ, a recess or organ-chamber has been built out from one of the sides for its reception. An old example of such an organ-chamber exists in the chapel of Christ's College, Cambridge; a second occurs in the chapel of Hampton Court Palace. The tone of an organ so placed is much weakened in consequence, as it cannot begin to spread and disperse till it has passed through and over the front of the case. The natural disadvantages of such a situation, however, can be considerably modified by making the chamber of ample dimensions, by lining it with wooden boards, and by furnishing it with a hollow wooden flooring. It is also of the highest consequence that there should be plenty of space between the top of the case and the turn of the arch; otherwise there will be no possible means of egress for the tone, which will then be smothered. All these precautions were taken in the construction of the organ-chamber at the Temple Church, the flooring of which is eight feet above the level of that of the church, the great organ sound-board being nearly another eight feet above the chamber flooring. There is also plenty of space between the top of the organ and the roof of the chamber.

1038. An organ that stands in a recess certainly appears to possess less strength of tone than if it were placed at the west end; but if there be plenty of head room over the pipes, and attention is paid to other circumstances favourable to resonance, what the instrument loses in power it frequently gains in sweetness of quality and cathedral-like character of tone; and, as the loss of power can be easily compensated for by disposing additional stops, there appears to be no reason why an organ should not tell fully as well at the side as from the west end, if every

means be taken to make it do so. This is specially the case with the organ in the Temple Church.

1039. By this it is not meant that an organ placed in a side recess will tell as well as the same kind of organ would at the west end with space around it; but that if it be judiciously *enlarged*, in proportion to its *loss of power*, so as to counteract the otherwise ill effect exercised by the recess, it will then sound at least as well as the unenlarged west end organ. The distinction here intended to be drawn is well illustrated by the difference produced by a choral staff of a given number singing *forte*, as compared with a more numerous body singing *sotto voce*. Supposing the strength or abstract power of sound produced by each to be about the same, yet there will be a marked difference in the *quality* of the tone, which, under many circumstances, will be in favour of the larger, but softer, sounding body. The subduing influence of a recess, in a similar way, frequently imparts to the tone of an organ a certain chasteness and kindliness of character, as well as a slight haziness—as though a fine veil were drawn over it—that is exceedingly pleasing, and even beneficial, if the volume and fulness of tone at the same time remain unreduced. The organ in Leeds Parish Church is a very successful example of an instrument placed in a transept, and causes one to regret that the magnificent new organ at Doncaster does not enjoy the advantage of a similar position.

1040. At Lübeck, the "little" organ in St. Mary's Church—which, by the way, has upwards of thirty stops, including ten on the Pedal—partly projects from the east wall of the south transept, and partly stands in a recess in that wall. The Choir organ, containing ten ranks of Mixture, stands in front; and the effect of the instrument is altogether most admirable. The treatment of the position, so as to give to a moderately deep organ only a shallow projection into the church, is both ingenious and successful. Neither the view of the building, on the one hand, nor the tone of the instrument, on the other, is destroyed. This organ is said to be about two hundred years old.

1041. A most unfavourable plan, usually, for the tone of an organ is that of putting the instrument in a recess, and placing the front pipes so as to form an ornamental *filling up* of the arch. With walls on three sides, and a tier of large pipes entirely occupying the fourth, the tone can only force its way through the interstices between the pipes, as water escapes through the fissures in a flood-gate. The contrivance is frequently more calculated to keep the tone back than to let it out. The organ at All Saints' Church, Manchester, built by Kirtland and Jardine, of that town, is most picturesquely treated, it being divided, and a portion placed in a recess on each side the chancel; but the Pedal Open Diapason, which produces a very bold effect in the recess where it stands, sounds in the church as weak as an ordinary Pedal Stopped Diapason. At the church of St. Mark, Old Street Road, the organ was similarly placed in a chamber; and the calculation of the organ-builder, Bevington, was that only *one-fourth* of the tone of the instrument found its way into the church. The melody of a chorale played out on the Great Diapasons, Principal, and Trumpet of this organ sounded no stronger than it would have done on the Stopped Diapason and Clarionet of most instruments that are favourably situated. The good taste of those in authority, however, had this mistake satisfactorily remedied long since.

1042. The worst possible arrangement is that of putting the *organist*, as well as the organ, into a chamber at the side; filling up the arch, as before, with pipes, which form an ornamental wall between the player and the congregation. This arrangement *did* exist at St. Mark's, Old Street Road, where three-fourths of the organ-tone was boxed in, and which, returning and descending on the organist, produced a din around him like that heard from a peal of bells in a belfry. The

wall of pipes was not only a serious impediment in the way of the organ tone travelling into the church and reaching the congregation; but, telling both ways, it was as effectual a check to the voices of the congregation entering the recess and reaching the organist. Added to this double impediment, the deep humming sound which the ornamental pipes, forming the bass portion of one of the stops in most constant use—the Open Diapason—was producing between the congregation and organist presented another difficulty in the way of the one hearing the other. This arrangement was, therefore, soon abandoned.

The east end of an aisle, or a chancel chapel, as the situation of the organ considered.

1043. It has been a frequent custom during the last few years to place the organ either at the east end of one of the aisles, or in an organ chapel on one side of the chancel. These arrangements are preferable to the one last noticed. In such a situation it is necessary (1) that the ground should be of wood, and hollow; (2) that the sound-boards should be kept as high as possible; (3) that there should be a good amount of clear space over the organ; and (4) that as much ground space as possible should be allowed for the organ.

1044. The wooden floor increases the resonance, concerning which all has been already said that is necessary. The elevation of the sound-boards to a satisfactory height causes the mouths of the pipes to range above the heads of the congregation, whereby their tone is more likely to travel before it becomes partially absorbed, instead of being partially absorbed before it travels. It may easily be surmised how comparatively dull and muffled a clergyman's voice would sound were he to stand only on the same level as the congregation; and the tone of an organ that has its sound-boards kept low will have a decided tendency towards the same fault. If the mouths of the pipes generally can be kept as much above the level of the vocal choir as those of the choir are above the level of the congregation, it will be so much the better both for singers and organ.

1045. The space over the organ relieves the tone of the instrument from the force and hardness which its contracted situation, as compared with the west end, is otherwise very liable to impart to it; while the greater space allowed for the organ admits of the pipes being planted in a less crowded and confused manner. Of the quantity of wind that enters at the foot of the pipes something like three-fourths of it passes out again at the mouth, a comparatively small portion only entering the body of the pipe. From this it must be obvious how necessary it is to allow the pipes the utmost available room to *speak* in. When this is not the case, some pipes have to be mounted on longer feet; others turned this or that way; and others grooved off here and there; not from design, or preference, but from necessity; and which "packing and contriving" give to the interior of an organ a very unsystematic and disorderly appearance.

1046. If the organ be placed in a chancel chapel, there should be an arch—the more lofty and wide the better—opening into the aisle, as well as one towards the chancel. The importance of this arrangement is explained by the first fact mentioned at the commencement of this chapter, regarding the propagation of sound; and its object is to allow the tone of an organ to pass down the aisle as well as across the chancel. When there is no second arch, the whole strength of the organ tone is directed towards the vocal choir in the chancel, which is then more liable to be overpowered by it at the same time that the congregation will experience scarcely any support from it. If there be two arches, and they are simply separated by a column or a pier, this will be more favourable to the egress of the tone than an angle formed by the junction of two walls, and having a hollow angle inside; which latter is apt to catch and throw some

of the tone back, while the former would allow it to pass round and proceed onwards, diagonally, into and across the nave of the church.

1047. As much free space as possible should also be left near to the organ. This enables the tone to get fairly from the instrument before it begins to be absorbed by the dresses of the congregation. The organ in the "Catholic and Apostolic Church," Gordon Square, built by Gray and Davison, which stands at the end of the south transept, on the ground, has plenty of free space around and over it, and sounds very freely in consequence. Space being left and the congregation not being seated so near to an organ, together, allow of the instrument being voiced more boldly and church-like, with little ill effect and much good resulting. The conditions necessary to cause the tone to travel to the extremities of the church can then be better attended to, without causing inconvenience to anyone; but if seats be placed too near to the organ, those who occupy them will hear more of its tone than they wish, while their clothing will prevent its getting away, and reaching those at a distance so effectually, by absorbing some of it before it can do so.

1048. If the several precautions just enumerated be taken to prevent deadening the sound of the organ, and to lessen the partial and unequal distribution of its tone, to which all side situations have an unavoidable tendency, an organ may be made to tell very fairly in either of the positions just considered.

The chancel an eligible position for a divided organ.

1049. Another and more rare arrangement is that of dividing the organ, and placing a portion of it on each side the chancel, where there is room, as at St. Margaret's, Leicester. This plan is in every respect a most excellent one. It is scarcely, if at all, inferior, even in a musical point of view, to that of a divided west-end organ; while, under its working, the organ is accommodated, without being sacrificed, to other arrangements that are now considered essential in most churches. In the first place, as the chancel is generally more lofty than the side chapels, this circumstance admits of the sound-boards being kept up higher, the important advantage of which arrangement is already known to the reader. Next, as the chancel is sometimes not very much less in height than the nave, it affords nearly as much space over the instrument for the mellowing and sweetening of the tone. Thirdly, the chancel being only occupied by the clergy and choir, it is comparatively unencumbered by absorbents and impediments, which is highly beneficial to the tone. Again, the organ will still be at the "end" of the church—although the opposite one to that which it frequently occupies—with the whole length of the edifice before it, into which its harmonious tones can travel. Moreover, by being placed to the east, with the vocal choir nearer to the nave, it will occupy its proper subordinate position in regard to the voices. No one would ever think of placing the instrumental staff between the vocal choir and the audience in a concert-room; and an analogous arrangement is equally ineligible in a church. (In a theatre, the arrangement is different; but the *sunken* position of the band there tends to its subordination.) Such a distribution of the organ might lead to a new use of the instrument, of an antiphonal character; of the advantage of which, however, we have at present had no practical experience in this country, although it would perhaps prove a source of many very fine and legitimate effects. The two parts could ordinarily respond to each other, after the manner of the separate sides of the choir; and be united, by means of couplers, when the entire choir joined in bursts of joyful exultation. Many Continental churches are furnished with divided organs in the choir, or with two separate and distinct

organs; the effect of which, when used as above, is said to be singularly fine. Then, with regard to the construction of such an organ, as the two parts would stand *sideways*, and therefore would be seen only in *profile* from the church, their projection could be lessened, if room for greater breadth be allowed, whereby the view from west to east would be less interfered with. For the interior arrangements, the Abbé Vogler's system of pipe arrangement might be advantageously employed, as being admirably calculated to facilitate the progress of the tone through the side of the case towards the church. At All Saints' Church, Margaret Street, the organ is divided, and a part placed at the extreme of each transept. The result of this arrangement is quite satisfactory.

The relative position of the vocal choir and organ.

1050. Respecting the relative position of the choir and organ in a church, concerning which a few words may here be said, it may be accepted as a good general rule that, if the organ is to be in a line with the choir, it should not be on a level with it; and, if it is to be on a level with the choir, it should not be in a line with it. That is to say, the choir should never be subjected to the direct force of the tone of the instrument. When it is so—as, for instance, when the organ is placed immediately behind one-half of the choir—that half hears the tone too strongly and palpably, while the clothing of its members deadens it before it reaches the other part of the choir. No given amount of organ tone, whether much or little, is then so equally and agreeably distributed to both. When the organ is out of a line, but on a level, with the choir, the choir hears its tone, as it is spreading, with less force, but with equal distinctness; when it is in a line with the choir, but elevated above it, the choir catches its sound as it descends in the course of its propagation. But, inasmuch as the sound produced at an elevation is necessarily less under the absorbing influence of the clothing of the congregation below, the plan of putting the organ "in a line with the choir, but above its level," is the preferable one. The tone of the organ can then reach the congregation and support its voice, as well as that of the choir. Hence the excellence of the arrangement at the Temple Church. At the church of St. Mary Magdalene, St. Pancras, the organ is above the level of the choir, but out of a line with it, and also produces a good effect.

Recent arrangements in cathedrals.

1051. Much pains have been taken within the last few years to find a better place, architecturally speaking, for our cathedral and minster organs.

1052. At the time the alterations in the interior of Westminster Abbey were in contemplation a very excellent article appeared in the *Parish Choir*, No. 20, for August, 1847, from the pen of the Rev. Sir William Cope, in which it was proposed to erect the organ at the west end of that church, and at the same time to strengthen its tone as much as possible. The solid stone Choir screen was proposed to be placed at the west end, so as to extend across between the first pair of pillars of the nave, with its architectural face to the east. The entire expanse of the minster, from west to east, from the ground to the roof, would then have been seen at one view. "Let our readers," says the article alluded to, "now consider how splendid the whole expanse of the church thus laid open would be. Looking to the east end, the eye would rise from the altar to the screen, and be led up by the beautiful apse to the vaulting of the roof; and, if the spectator turned toward the west, he would see the stone screen sur-

mounted by the organ; above that would appear the whole extent of the perpendicular window, with its coloured glass running up into the vaulting of the roof. And if, besides these architectural beauties, the eye of the Christian spectator were to rest on the vast multitude who (we are sure) would throng the expanse, and to see a reverent and attentive congregation joining, as they would then be able to do, with one mind and one heart and, we trust, with one voice with the clergy and choir of that glorious church, in those majestic hymns which form the Choral Service of the English Church, would it not be a sight to which English Churchmen might point with an honest exultation?" This proposition possessed the unusual recommendation of treating the question musically as well as architecturally; and, besides this, of providing for the orderly arrangement of a vast congregation. As the arrangements were subsequently carried out, the choir screen was retained in its former position; the organ was divided into four portions, the Great organ being placed within an arch on the north side of the church, the Swell under the corresponding arch on the south side; the 32-feet Pedal pipes were laid horizontally along the west side of the screen, while the Choir organ hung over the east side in the usual way. The tone of the organ, on the whole, tells exceedingly well, although the instrument is so much broken up, which, no doubt, arises partly from the two main portions not being put too much under the side arches, but partly projecting out from under them; and, again, from the organ having been *considerably enlarged* at the same time.

1053. At Ely Cathedral the organ, as reconstructed by Mr. Hill, under the direction of the able architect, Sir Gilbert Scott, is a *hanging* one, the appearance of which is most gorgeous. It projects from the *side* of the choir, overhanging the stalls. The keys are placed behind—that is to say, on the aisle side—so that some portion of the organ is directly between the organist and the singers. The organ thus arranged is pleasant to sing to, and the organist can hear the *Choir* organ quite distinctly. The vocal choir, also, he can hear pretty well; but the tone of the Great organ does not reach him so readily.

1054. At Canterbury Cathedral the organ is placed in the triforium over the south side of the Choir, at a great altitude, and the keys are placed behind the stalls. The touch being both heavy and deep, it is a most laborious organ to play upon; and on account of the length of the action between the keys and the pallets, and the manner in which the tone has to find its way down into the Choir, a perceptible interval occurs between the keys being struck and the sound being heard.

1055. In making praiseworthy endeavours to find a less prominent locality for our cathedral organs, every facility should be provided for the organist hearing and seeing the choir, and *vice versâ*. For this purpose it would be an admirable plan to make the organ play *at the side*. This arrangement has so many recommendations, and not one drawback, that it is surprising it should not long since have been generally adopted. The organist, by a mere turn of the head, would then have at least half the choir under his view, and could, by a gesture imperceptible to the congregation, convey a suggestion down to its members. Moreover, the organist would in all cases hear the voices much better. In the instance of an organ on the Choir screen, if the keys were placed in the manner here suggested, the organist could probably see *both* sides of the Choir, instead of *neither*, as at present, and at the same time he could also see to both ends of the cathedral. Another important end would be gained by placing the keys of a cathedral organ in the manner under consideration. The space of the organ-loft could be taken into the Great organ case, by moving the east front

forward to the back of the Choir organ, and inserting new panels to fill up the openings in the sides, which would admit of a material improvement in the organ, by admitting of the introduction of many large pipes, on the tone of which the true dignity of the organ so much depends. The arrangement above recommended may be met with in Snetzler's organ at Beverley Minster, which instrument, standing on the Choir screen, has the keys on the north side. It has also been recently adopted by Sir Gilbert Scott in the restoration of the organ in Rochester Cathedral.

CHAPTER XXXIV.

THE SIZE OF THE ORGAN.

The organ should be proportioned to the congregation and church.

1056. THE size or contents of the organ should, as a rule, be regulated by the number of the congregation whose united voices the instrument will have to sustain, and by the dimensions of the church in which it is to be placed. This is assuming that usefulness of instrumental support, as an aid to the voice in devotional exercises, is admitted; which point, however, is not conceded by some religious denominations. The question before us, however, is not whether an organ is admissible for the purpose above specified, but—that opinion being supposed to be acquiesced in—what should be the properties and attributes of the instrument to render it adequate to its purpose. The size of the organ would also be influenced by the kind of stops chosen, whether they are chiefly of loud or soft intonation; Dulcianas, Flutes, and Piccolos usually having little to do with the power of an organ, although they increase the number of its stops, and materially add to the number and variety of its soft and agreeable combinations.

Certain influencing circumstances to be taken into account.

1057. The acoustical capacity of the church, again, must be taken into account; some churches being as good for sound as others are bad, as is well known to most clergymen, who find little difficulty in filling some, while they have great trouble in making themselves heard in others. If there be much echo—a circumstance that may soon be ascertained by sounding the voice in various parts of the church—such a natural advantage will be much in favour of the organ; but if the sound do not get away, but immediately fall dead, then more stops should be disposed, to enable the organ-tone to make its way; or a greater proportion of loud stops might be introduced; or the whole should be more strongly voiced and blown. Some such steps would also have to be taken if the organ is to be placed where its tone is likely to be weakened; as, for instance, in a recess.

An approximate calculation of the number of stops necessary for an organ to have.

1058. From what has just been said, it is obvious that the number of stops necessary for an organ to have cannot be deduced with absolute certainty from the number of the congregation, although an approximation to it may be drawn from that source. According to Seidel, for a congregation of from 200 to 300 persons, an organ with from 8 to 10 stops may suffice; for one of from 400 to 500, an organ of from 12 to 16 stops; and for a congregation of from 1,000 to 2,000, an organ of from 24 to 30 stops. In this calculation allowance is not made for half-stops; still less are the couplers and other mechanical contrivances taken into account. Half-stops are of comparatively rare occurrence in German organs, although short stops are common enough, particularly among the flute-work. When a stop only extends to tenor c, it is usually grooved into the bass octave of some other stop below, instead of that other stop being cut to draw in halves, as is the more

frequent custom in England. Neither are couplers included in the calculation, since they have no "voice"* at all. With these exceptions, and making some allowance for the addition to the number of a few soft stops that are in great favour in this country, the above calculation is a very good one.

Too small an organ in a church most undesirable.

1059. As it is quite as great an evil to design too small an organ for a large church as it is to plan too large a one for a small church, it may be well to explain why an instrument of fair proportions may with confidence be admitted into a place of worship. The primary purpose for which an organ is introduced into a church is to support and direct the voices of the congregation. It therefore becomes necessary to ascertain, if possible, what may be the strength of that congregational voice which the organ is expected to sustain.

The strength of the human voice as compared with that of the organ wind.

1060. To this a clue may be obtained by a very simple experiment. If an anemometer be provided with a flexible tube, furnished at the end with a large mouthpiece, and the breath be freely expired into it, the index prepared at the side will show that the human lungs produce, without any very great exertion, a current of air of 9 or 10 inches pressure, the Manual departments of a church organ being ordinarily voiced to a wind of from $2\frac{1}{2}$ to 3 inches pressure. This result, perhaps scarcely expected by many, makes it apparent that the human voice, when firmly delivered, is sounded by a wind 3 or 4 times the strength of that which ordinarily gives speech to a church organ. Then the sound-waves which surround every singer—as they encircle an organ pipe that is speaking—are proportioned in strength to the power of the voice that originates them; and at the same time they to some extent prevent his hearing other external sounds distinctly.

The general requisites of a church organ.

1061. Now a church organ should possess sufficient fulness, depth, and *travelling* character of tone, to make its way through all other sounds to the ear of the congregation, and support, keep in tune, and lead the united voices of its members. Whether much or little organ will suffice for this is a question that much depends not only on the number of the congregation, and the dimensions of the church to which its size and power should in the first place be adapted, but also on whether the entire congregation takes part in the singing, or only a portion, and whether the many or few who tune their voices do so boldly or timidly. In those large churches abroad, wherein great numbers assemble, and among whom the singing is both general and zealous; where, in fact, may be heard the finest congregational music—namely, in some of the Protestant churches of Germany and Holland—there will also be heard the largest organs in the world. The "music mill" has long been considered the necessary concomitant of the "vocal thunder;" and the two have been exercised conjointly, from week to week, for centuries;—the one in uttering, in unison, the melody; the other, in playing, in fine progressive harmony, the simple and magnificent chorales of the former country, without the one injuring the effect of, or obscuring, the

* In German Specifications the stops are generally called *Klangbare Stimmen* (sounding voices), and the couplers and other mechanical contrivances, *Nebenregistern* (accessory or secondary registers).

other in the slightest degree.* And it is now tolerably clear why no ill effect should have resulted from this union of instrumental with vocal sound. It would not be easy for an organ voiced to a $2\frac{1}{2}$ or 3 inch wind to interfere with an assemblage of 800 or 1,000 voices, singing with a strength equal to a 9 or 10 inch pressure of organ wind, if its tone be rich and full, and its stops well balanced.

An organ of sufficient dimensions in a church a great acquisition.

1062. A fine organ, then, may fairly be considered as a great acquisition for a church to possess; provided, of course, that its powers only be fully exercised on rare and befitting opportunities. Dr. Spark, in his pamphlet on *Choirs and Organs*, page 11, gives a good instance when the full peal of an organ may be beneficially employed. "Who," he writes, "can have heard a crowded congregation in a large church sing with heart and voice that glorious, time-honoured tune, the Old Hundredth Psalm, accompanied with the full power of a great and beautiful organ, and not acknowledge the powerful aid and thrilling effect which a grand organ gives to some portions, at least, of our Church Service?" At such times the propriety of a cheerful accompaniment is at once recognised by the members of the congregation; they raise their voices, energetically and earnestly, under the combined influence of the service, the occasion, and the appropriate tone-character of the organ—the trebles, singing in unison with the melody, and the tenors and basses below, add immense strength, in the *Unison and Double Diapason pitch*, to the mass of musical sound, the result being that the choral song stands out distinctly in bold and grand relief through the dignified and impressive peal of the full organ.

1063. Thus much has been said to illustrate what an organ should be *capable* of when the upraised voice of the congregation may put its powers to the test. Of course, there are times and seasons when the hymn of praise and thanksgiving would be hushed, and the song of sadness raised in its stead, and on which occasions the organ tone would, of course, be reduced to accommodate it to the altered sentiments of the words. The strength of the congregational voice itself would also, at such times, be much subdued. With regard to the organ, however, this forms an entirely separate question; and presents no subject for consideration, while the power requisite for the instrument to possess is being discussed, but rather bears on an important matter connected with its after-use. On this latter head much has been said in a former chapter; it need, therefore, only be added in this place that when a subdued tone is desired—produced, of course, by using a portion only of the organ—those stops should be selected that will give the requisite "tone-colouring" to the words, *in addition to* affording the exact amount of support required. On this point a very correct idea will be obtained of the manner in which an organ should be used, by a reference to the vocal and instrumental scores of Mozart, Spohr, Mendelssohn, &c.; from which it will be seen that, however extensive the orchestra at disposal, their authors have not yielded to the temptation of using a single additional instrument beyond what was necessary for the particular purpose; but have first confined themselves within the proposed limits, then

* It should be mentioned that, while unison singing is at once the most simple in kind, the most easy of execution, and the most appropriate for a congregation to adopt, it is at the same time the most powerful in effect, from its concentrating all the vocal force into one part; and is, therefore, the kind of congregational singing that requires the most organ for its support.

proceeded to select such instruments for use as would sympathise the most closely with the words to be sung, and yet at the same time produce so *transparent* an effect that the voice could be heard clearly and definedly through the whole. These are precisely the several processes that should be gone through to secure the best, because the most appropriate, kind of subdued organ tone for accompaniment; that is, if the organ admit of a choice.

The power of an organ partly due to its extent of tone.

1064. It was stated just now that, while an organ is commonly voiced to a $2\frac{1}{2}$ or 3 inch wind, the human voice is frequently produced by a current of air equal to a 9 or 10 inch wind. This fact would seem to imply that the tone of an organ must be much weaker than that of voices; and, although the above figures may or may not represent the *exact* comparative strength of the two, yet there is no doubt of the fact that *Unison* stops alone in an organ would be quite unequal to the support of a large body of strong voices. Organs, therefore, are never made with this one class of stops alone, because they then could not possess the requisite nerve, ring, and power. The "power" of an organ is, in a great measure, due to its greater *extent* of tone, as compared with that of voices, *pitch* exercising a marked influence on its loudness. Everyone is aware that in a quartet sung by the four varieties of male voices the treble part always sounds the most prominent, *not* because the boy's voice is the most powerful, for it may be the weakest, but because it is the *highest*. So great is the influence which acuteness of pitch exercises that the general ear, and consequently voice, will follow the upper part of a four-part harmony, whether it should do so or not. Of this a remarkable instance is given on all occasions when Tallis's Responses are sung in cathedrals, *i.e.*, on church festival days. The chief melody, or "Plain-song," is set in the tenor, for which reason it remains unrecognised by the congregation generally, who never follow it, but, on the contrary, take the treble or acute part, which in reality is only a portion of the choral accompaniment.

1065. Now, for the same reason that the adult male members of a congregation hear the trebles so much more clearly than the choir voices that are in unison with their own, the trebles hear those of an organ stop that sounds the octave above their voices much more distinctly than those that are in unison therewith. This fact must be familiar to all who have had much experience in accompanying a choir, and who will have noticed this illustration of it, that, if the treble voices get flat, they will be set right much sooner by drawing the Principal, or by playing the melody in octaves, which will produce the same kind of effect, than by adding a number of other Unison stops. The addition of one Principal to the Great Diapasons will at such times be heard more distinctly by the trebles, and will exercise a far greater corrective influence than the addition of three or four Unison stops from the Swell, by means of coupling, even if there be one or two reeds included among the number. This, however, does not arise from any greater *power* possessed by the Principal (for in that respect it is rather inferior to the other accessory mentioned), but from its *acuteness*. The influence of high-toned stops extends still further. For the same reason that the Principal adds clearness to the Diapasons, the Fifteenth and Twelfth impart a cheerful ring to the tone, while the Mixtures add brilliance and vivacity, perhaps keenness, if they be voiced too loud, as is too frequently the case. So much for the stops sounding *above* the Unison. But the remaining stops also fulfil certain important conditions. The Unison and Double stops impart a fulness to the tone that is appreciably felt by a choir and congregation, and conduces, in conjunction with the

Pedal bass, to convey that sensation of *nearness* of accompaniment to the singer that is of such essential consequence in infusing confidence and affording encouragement to those who need support. The Pedal bass, in its turn, marks the progress of the music, and that much more effectually than any of the other stops could do. Summing up, then, in a few words, the influence which the three classes of stops exercise: the Octave and other acute stops tend to keep the voices in tune; the Unison and Double Manual stops afford them support; while the Pedal Diapasons, by marking the time in the course of the onward movement of the music, keep them together.

How the acoustic capacity of a Manual organ is increased to adapt its tone to a large building.

1066. What has hitherto been said has had more especial reference to the requirements of an organ as an accompanimental instrument. But it is necessary also to consider by what process of development an organ, as an independent instrument, is made to fill, with its musical tones, a building, however large its dimensions; particularly as this point has not the less bearing on the question concerning its efficiency and excellence in the capacity already considered. The presence of a Double Diapason has already been mentioned as being necessary in an organ to support the tenor and bass voices in a congregation, as the Unison do the trebles. But a stop or stops of that size are required to fulfil another end, totally distinct, but of not inferior consequence. If a chord be played in the treble part of the Great organ of an instrument placed in a large building, and not having any stops lower in pitch than the Unison, there will be perceived a certain *smallness* of effect, which makes it evident that, although the treble may possess sufficient brightness and intensity, perhaps even amounting to shrillness, yet it lacks the amount of fulness and volume necessary to produce an ample and dignified tone. This arises from the fact of even the Unison pipes in the treble being comparatively acute in their sound, and, therefore, in the very nature of things, unpossessed of stately impressiveness. It thus becomes obvious that the harmonic corroborating series of stops alone do not present *all* the resources necessary to form a satisfactory organ. Something that is essential appears to be wanting, and a fresh element is felt to be necessary to supply that absent property.

The acoustical grounds on which Double stops are introduced into an organ.

1067. The property wanting is *gravity*, which possesses a character peculiar to itself, and for the absence of which no amount of *intensity* in the other sounds will compensate. Of the travelling and filling-up character of grave sounds we have already spoken, and of the fact itself a sufficient illustration is given in the circumstance of a chant sung by twenty tenor and bass voices in unison pervading a building more completely than if sung by thrice the number of trebles. Again, the deep tone of a Pedal Diapason will travel through a building more entirely than a double chord of six or seven notes played on the Manual Diapasons, from middle c^1 upwards. Its sound will certainly not be nearly so well defined, but it will be of a more pervading character. The want felt, and above specified, however, is not a *substitute* for the harmonic sounds, but a new element, which, *added* to them, shall render the general tone larger and more ample. It is worth mentioning that this want was so much felt abroad nearly three centuries and a half ago, that means were, even at that period, taken to supply the deficiency. It was about the year 1508 that a covered stop of 16-feet size of tone was invented in Holland;

and which, to some extent, imparted the necessary, deep, resonant, *humming* effect to the other stops, and was hence expressly called *Bourdon;* a name that means a hum or drone; and which stop has never ceased to be highly valued abroad to this day.

1068. The strength of this under-sound has to be regulated by the size of the organ and the dimensions of the building in which it is to stand. For a small church organ a *Lieblich* Bourdon is sufficient; for one of ordinary size a full scaled Bourdon (Double Stopped Diapason) will be ample; for a larger instrument a Double Open Diapason is also required, perhaps accompanied by Double Mutation stops; for a still larger one a 16-feet Double Trumpet is necessary; and for organs of first-class magnitude a small Sub-Bourdon, in addition, of 32-feet tone, as far as the fiddle g or tenor c key, sounding GG or CCC. In the bass octave the 32-feet sound can be produced *acoustically* by means of a Bourdon and Quint of $10\frac{2}{3}$-feet tone. When a Manual organ is thus developed, the tone of its Treble is so ample, that it may be used by itself without any insignificance of effect in the largest buildings.

The effect of a large organ not constructed on acoustic principles as well as on harmonic.

1069. It has been thought necessary to enter thus fully into this subject, because there are many who hold that all double stops are inadmissible, from the circumstance of their not being included in the harmonic suggestions of nature. This opinion, however, does not imply a complete view of the question. The rearing of a large organ is not governed simply by the laws of *harmonics*, but also by the laws of *acoustics*. The former have already been sufficiently considered in the previous chapter; and it only remains here to point out what an organ becomes, when the claims of the latter are overlooked. The greater the number of stops introduced into the Great organ, and the greater the quantity of chorus-work, the more is the tone of the Treble *drawn upwards*. The greater the number of ponderous stops put on the Pedal, the more the bass is *drawn downwards*. As the size of the instrument is increased, so is this effect of the *severance* of the two parts in proportion; which accounts for the fact of the largest organs, built *not* on acoustic principles *as well* as on harmonic, being the greatest failures. The two parts contain no one property or characteristic that is common to both. Instead of the Manual tone being extended downwards to meet the Pedal, by means of Doubles, &c., and the Pedal being extended upwards to meet the Manuals, by means of small stops, &c., the 8-feet and smaller tones of the former, and the 32-feet tone of the latter, draw the two asunder. The sharpness and acuteness of the one, and the depth and fulness of the other, instead of producing the effect of harmonious amalgamation, convey an impression of the two parts being engaged in an altercation. It then becomes necessary for the left hand of the organist to be employed in holding down nearly every concordant note within reach, and as low down on the Manual as possible to disguise the deficiency.

1070. It is not consistent with the real dignity of the instrument that its good or bad effect should depend on the player's power of hiding a defect. All the properties and attributes for producing the best and a perfect effect should be embodied in *the organ itself;* but this will not be the case unless what is acoustically necessary is provided, as well as what is harmonically so. Besides, a certain combination of concordant sounds, as a note and its fifth, will generate *sub*-harmonics or undertones—in this case, the octave below; and this phenomenon, without doubt, first suggested the introduction of "Doubles." Deep tones were felt to be a necessity; and the laws of acoustics suggested what those sounds should be.

CHAPTER XXXV.

VARIOUS MATTERS CONNECTED WITH THE DIVISION OF STOPS, AND THEIR SELECTION ACCORDING TO SIZE.

The proportionate division of a given number of stops among the several departments.

1071. In distributing a given number of stops among the several departments of an organ, care has to be taken not to devote too great a proportion of that number to one department, and so few to another that the latter will be insignificant beside its compeer; but the endeavour should be made to develop all the departments that are proposed to be introduced gradually and proportionably.

1072. The Great organ, as being the most important department, and the one required to have the fullest tone, should have the greatest number of stops. The second Manual (Swell) need not have quite so many, although the difference ought not by right to be great. The third Manual, if there be one (Choir), would have somewhat fewer again. For the Pedal the *minimum* proportion should be one third as many stops as there are on the Great Manual. When even this proportion cannot be secured, there should always be an Octave Pedal Coupler, which is a stop of great use. Below the ratio just given the German and French organ-builders never descend, except for instruments of the most unpretending description. The *maximum* number for the Pedal is as many stops as on the Great Manual. The German proportion often exceeds this.

1073. According to the size of the proposed organ, the stops would thus be assorted into from 2 to 4 or 5 separate divisions. In so appropriating them two extremes have to be avoided; namely, of reducing a moderate number of stops into too many divisions, and of confining a large number of stops to too few claviers. By the former course, in consequence of the stops of every clavier having to commence with the unison, several and minute varieties of the same stops must necessarily be introduced, which might, under the circumstances, be very well dispensed with; while the effect of the whole is small as compared with what it might be. On the other hand, if a great number of stops be assorted into too few divisions, the stops that produce the more delicate gradations or shades of tone, if introduced, cannot then be used with the same facility, advantage, or convenience. A greater number of Manuals will always possess advantages over a smaller, provided the organ tone be not dispossessed of its proper dignity to secure them.

1074. As a rule, possessing sufficient accuracy to answer all general purposes, it may be laid down that an organ with 6 to 12 stops might have 1 or 2 Manuals; one having from 12 to 30 stops, 2 or 3 Manuals; and one with from 24 to 60 stops, 3 or 4 Manuals. In each case there should be separate stops for the Pedal, as far as possible.

1075. It may in some cases happen that there are large funds at disposal. If, under such circumstances, it be thought desirable to add to the comparative completeness and efficiency of the organ, without increasing its strength of tone, or throwing it out of proportion with the church, this could be done either by adding a second Manual organ (Swell); or, if that be already designed, a third

Manual organ (Choir); or it might be effected by proposing extra stops of a delicate character of tone.

The size of stop that should form the basis of the Manual and Pedal tone.

1076. The next point to be observed is the size of the stop that forms the unison or basis of the Manual and Pedal tone. For all the Manuals this would be the same—namely, 8 feet—but for the Pedal, 16 feet. The stops first to be selected for the former must therefore be of 8 feet, or 8 feet size of tone; and for the latter, 16 feet, or 16 feet size of tone.

Stops of one size only for Manual or Pedal incorrect.

1077. At the same time it would be incorrect, for reasons already assigned, to place only 8-feet stops on the Manual, and only 16 feet on the Pedal. The effect of such a selection of stops, at first serious and solemn, would gradually become dull and monotonous, and then oppressive and dispiriting. Other and smaller stops are required to give life and energy to the organ tone, and to serve the numerous other purposes mentioned in former chapters.

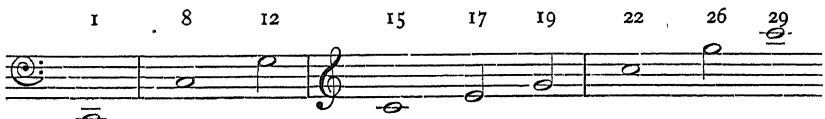
The proper size for the stops, and the order in which they should be selected.

1078. A table of the smaller stops just referred to was given on a previous page. All these, of course, cannot be placed in *every* Manual organ in the first instance. They are not indeed required; for the individuality of character in the tone of the several Manual departments depends as much on the size and proportion, as on the choice and scale of the stops with which they are each furnished.

1079. Where, however, fulness and power are required, as is always the case with regard to the Great organ, the series of smaller harmonic or corroborating stops should be introduced in a complete form as soon as possible, or the above-named essential requisites will not be secured to the full extent. The Principal, 4 feet, is the first stop of the series to be introduced, after the Unison stop itself. Next to that, the Fifteenth. It is a rule never to propose a Third or Fifth-sounding rank without the Octave-sounding rank the next smallest in size to itself being also introduced to cover its tone. This is why the Twelfth is never disposed before the Fifteenth; although its size is $2\frac{2}{3}$ feet, and that of the latter only 2 feet. In like manner the Nineteenth, or Larigot, should always be accompanied by the Twenty-second or Octave Fifteenth, otherwise the Mutation tone may appear remarkable, or even offensive.

The stop from which the harmonic corroborating stops must be measured.

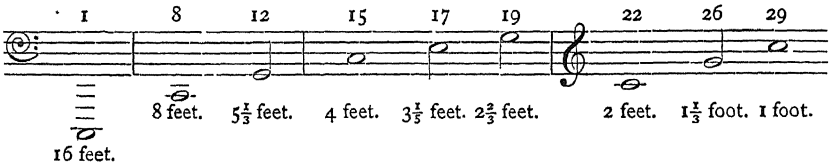
1080. As the tone, on the one hand, would tend towards thinness if any of the requisite Mutation ranks were to be omitted, so, on the other, it would become thick and vague if Mutation ranks of too great size were to be introduced. It is necessary, therefore, to bear in mind from which stop the harmonic series should be measured, as this will prevent the occurrence of either error. The proper stop to be used for this purpose is the largest one of the Open Diapason species proposed to be placed on the same Manual. If that stop is to be of 8 feet, the harmonic corroborating series would, for the theoretical reasons before explained, be as follows:—



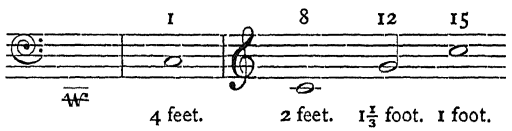
1081. The order of the harmonic corroborating sounds will easily be committed

to memory if the series be viewed in this way. All the octave sounds are required. The interval of the first octave from the fundamental tone must not be broken; the second should be broken by a Fifth only; while the third may be broken by a Third* and Fifth. In the above example the filling-up sounds in their correct situations are represented by minim notes.

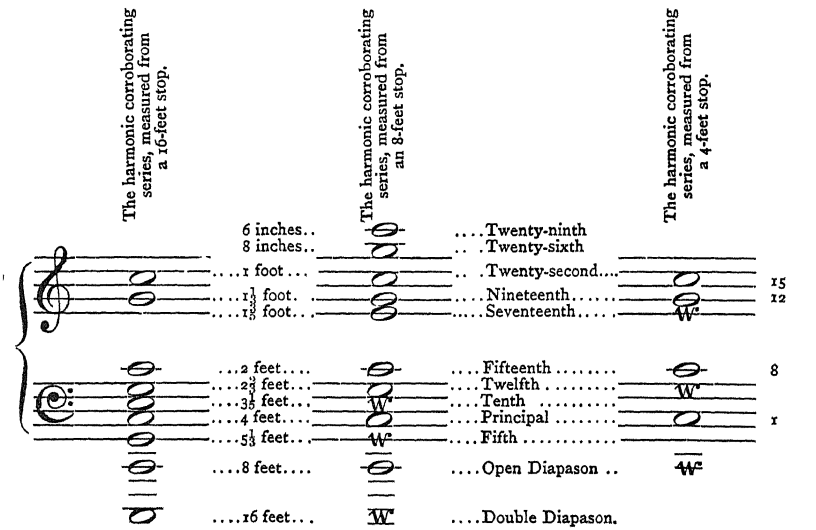
1082. If a large organ is proposed, having a 16-feet stop, Double Open Diapason, the harmonic corroborating series of that fundamental sound will be of the following sizes and pitch :—



1083. For a small Choir organ, having no larger stop of the Open Diapason species than the Octave or Principal of 4 feet, the following would be the proper sizes for the harmonic series :—



1084. As to the naming of the stops of the Manuals, this point is always decided in England by their pitch in relation to the unison tone of those departments, as shown in the following scheme :—



* In Germany the Tierce is not commonly introduced into new organs of moderate dimensions, on account of its not harmonising so well with the slightly sharpened thirds of the equal temperament. The flat Twenty-first is never included, even in the largest organs of that country.

1085. We perceive, from the middle column of the above scheme, that, when the largest open cylindrical stop of full scale is only of 8 feet, it would be wrong to introduce either a Fifth or Tenth (see directs); because they form no portion of the 8-feet harmonic series, but of the 16. Or, to put the fact in a *practical* instead of a *theoretical* form, the Fifth would break the first octave from the fundamental tone, and the Tenth would introduce a second filling-up sound into the second octave. In *effect*, these would, under such circumstances, obscure the Foundation tone, and render the whole thick and indistinct.

1086. The Twelfth, on the contrary, would be a necessary stop to dispose to an 8-feet ground tone. This, however, in its turn becomes inadmissible, when the largest stop of the Diapason species is only 4 feet in length; as shown in the third column of the above scheme.

The meaning of the German terms, 16-feet Manual, 8-feet Manual, and 4-feet Manual.

1087. As the meaning of the German terms, "16-feet Manual," "8-feet Manual," and "4-feet Manual," are by no means generally understood, an explanation of them may not be uninteresting in this place. They have by some been supposed to signify a CCC Manual, a CC Manual, and a Tenor c Manual respectively; whereas, in reality, they refer to nothing of the kind. The German Manuals never descend below CC, and in modern specimens they seldom fall short of that compass. The terms refer to the size of the greatest stop of the Open Diapason kind on the Manual to which either of the three may be applied. If the stop in question be of Sub-octave pitch, corresponding with the English Double Open Diapason of 16 feet, the Manual on which it stands is said to be a 16-feet Manual. If it be of 8-feet length, the Manual is said to be an 8-feet one. If it be of Octave pitch, it is said to be a 4-feet Manual. The fact of there being a Bourdon of 16-feet tone, and perhaps even a "Gedact-Quint," or a "Rohr-Quint" (Stopped Fifth, $5\frac{1}{3}$-feet tone), does not affect the classification. In the same manner, the presence of the Stopped Diapason, and perhaps other Unison stops not of the governing kind, are again not permitted to affect the classification.

Stops of one class alone not sufficient to produce the best organ effect.

1088. Two facts have already been mentioned, that the harmonic corroborating series of stops are usually formed of pipes of the Open Diapason species, and that the presence of that series is essential to the production of a full and satisfactory organ tone. At the same time, those stops do not present *all* that is necessary to produce the best attainable effect. No single class of stops can do this. For instance, Open stops of the Diapason kind, alone, would produce rather a cutting tone; an organ entirely of Covered stops would sound weak and muffled; while one composed entirely of Reeds would be too strong and penetrating. The four great classes of organ stops—Open, Covered, Flute, and Reed—are, in fact, to a great extent dependent on each other for the production of the most satisfactory result. The Covered stops impart a quiet solidity to the Open stops; the Open stops bestow roundness and firmness on the Covered stops; the Flute stops give variety and increased character to the soft combinations; while the Reed stops impart to the full organ stateliness and splendour, and in return receive fulness and brightness from the Open series of stops.

The proportion to be observed in the number of stops of different sizes.

1089. In selecting stops from the Covered, Flute, or Reed species, for addition to those of the Diapason kind, certain proportions should be observed in regard to the number of

each size proposed to be introduced, or the proper balance of the general organ tone will not be preserved. The foundation tone should in all cases predominate over the mutation sounds; and, in like manner, the unison sound should predominate over all the octave sounds. The former point is attained by *doubling* the number of 8, 4, and 2-feet ranks or stops; and the latter by introducing more 8-feet stops than of 4-feet, and a greater number of 4-feet stops than of 2-feet. For the regulation of these matters, certain general rules are laid down in Germany, which are embodied in what follows.

1090. A Great Organ Manual should ordinarily have, besides the Open Diapason, from one to three or four other 8-feet stops, according to the size of the instrument. In addition to these there should be a good proportionate number of 4-feet stops. Those latter should be, at the least, half as numerous as the 8-feet; and, if of those of 8-feet there should be an odd number, the balance should be given in favour of the 4-feet stops.

Thus—(1) to two 8-feet stops, there should be
one 4-feet stop;
(2) to three or four 8-feet stops, there should be
two 4-feet stops, and
one 2-feet stop;
(3) to four or five 8-feet stops, there should be
three 4-feet stops, and
two 2-feet stops.

1091. The stops should, in fact, in regard to their proportion and size, be arranged after the manner of a pyramid; lessening gradually as they rise.

Thus, for a small Great organ they should stand thus :—
to three 8-feet stops,
two 4-feet stops,
one $2\frac{2}{3}$-feet stop, and
one 2-feet stop.

The Twelfth would be required, to give that kind of "chorus" effect which is so desirable a characteristic for even the most limited Manuals of the kind to possess.

1092. A Great Manual that is to have 9 or 10 stops should include a Twelfth, a Compound stop, and a Bourdon. This would make the second of the three tables just given take the following form :—

One 16-feet sounding stop,
three or four 8-feet stops,
two 4-feet stops,
one $2\frac{2}{7}$-feet stop,
one 2-feet stop,
one Mixture of III., IV., or V. ranks—9 or 10 stops.

1093. If the Great Manual is to have 16 stops, it should include two 16-feet stops and a Quint of $5\frac{1}{3}$ feet. These would give to the third table the following form :—

Two 16-feet stops,
five 8-feet stops,
one $5\frac{1}{3}$-feet stop,
three 4-feet stops,
one $2\frac{2}{3}$-feet stop,
two 2-feet stops,
two Mixtures, comprising VIII. ranks—16 stops.

1094. It will be understood, from a glance at the foregoing tables, that it must be improper to propose two Twelfths with but one Fifteenth to cover them. If they were to speak out properly, the fifth sound would certainly be stronger than the octave, and the predominance of the foundation tone would be to some extent obscured. There would then appear a certain thickness and nasal quality in the tone. It would be equally wrong to propose a greater number of 4-feet stops than of 8-feet, or a greater number of 2-feet than of 4-feet. Either of these latter miscalculations would have the effect of drawing the tone up from the unison pitch, whereby the requisite fulness and gravity would be lost, and an undue brightness and thinness substituted. It is equally bad to dispose a full-toned and powerful 4-feet stop with only a delicate 8-feet stop to support it; yet this is frequently done in modern Choir organs.

1095. The foregoing schemes and observations have more immediate reference to the properties requisite for the Great organ to possess. They, however, apply equally to all the Manuals, and indeed to the Pedal also; but the Swell and Choir organs are seldom furnished with as many stops as the Great; and, moreover, are not developed in the same manner. For instance, the harmonic series of stops are among the first to be proposed for the Great organ; their importance is shared by the Reeds in the Swell; while, in the Choir organ, they are the very last that find admission.

1096. The Swell may be considered as an Echo to the Great organ in one sense, and as a Solo organ in another; and the stops that are selected for it in these two capacities render it a most valuable division of an organ for accompanimental purposes.

1097. To serve as an Echo to the Great organ, the Swell should have, besides two Unison Flue stops, the harmonic-corroborating series of ranks complete, as far as practicable; and it should be the first, after the Great organ, to have a Bourdon. As a Solo organ, it requires at least one soft Unison Reed, even sooner than the Great organ. The proportion in the number of Unison and Octave stops, even in a small Swell, will, therefore, almost of necessity stand in the following ratio, namely:—

to three 8-feet stops,
one 4-feet stop.

For a larger Swell there should be two Unison Reeds and a second 4-feet stop, which might be a Clarion. The proportion could then be as follows:—

to four 8-feet stops,
two 4-feet stops.

It is quite wrong, as to effect, convenience, and completeness, to propose a Bourdon for the Swell before a Compound stop. One of the reasons why Reeds are so soon and so freely introduced into a Swell is that, on account of the stops being enclosed in a box, the tone must be of a more penetrating quality to make itself heard; and a strong and a weak Unison Reed are therefore proposed. It is also for the above reason that the second 4-feet stop proposed for the Swell is almost always a Clarion in preference to a Flute.

1098. The Choir organ should be of a *lighter* tone than either the Swell or the Great organ. By this it is not meant that it should be so very much *softer*. Choir organs have sometimes been voiced with the delicacy of a chamber organ; and have, therefore, for church purposes, been of little use. Excellent examples of what the comparative strength of the like stops in the Great and Choir organs should be will be found in some of the best old instruments which still remain:

not, indeed, that the Choirs of those organs present good models for literal reproduction ; for they are, or were, in their original form, very much out of proportion. It was a constant practice with the old builders to propose a Stopped Diapason only to stand against two 4-feet stops and one 2-feet stop. Instead of the unison tone being properly maintained by such a specification, it was completely overbalanced by the higher sounds, and a quality of tone was produced that was characterised by excessive thinness, in spite of its sprightliness. Probably this misproportion in the old Choir organs arose from the same cause which operated against the proper balancing of the old Great organs—namely, lack of room, want of funds, or both. In later examples of Choir organs a Dulciana was generally introduced ; but so weak a unison, even as an addition, was insufficient to reduce the strong-toned Principal and Fifteenth into proportion ; hence the custom was introduced of voicing the last-mentioned stops much more quietly than before ; and this twofold modification, while it certainly had the effect of producing a more equally balanced Choir organ, at the same time brought in the chamber quality, as already mentioned. The attributes for a Choir organ are lightness and variety, rather than fulness and power ; hence a given number of stops, that would in the case of the Great organ require a Twelfth and a Compound stop, neither call for the one nor the other when appropriated to the Choir organ. A good number of 8 and 4-feet stops, comprising delicate accompanimental and Solo stops, are among the first that should be selected for this department.

1099. The Pedal organ should contain a "Bass" to as many of the leading Manual stops as circumstances will allow. A good complement of 16 and 8 feet stops should first be disposed for this department, particularly as all smaller stops can be conveniently borrowed by coupling the Manual to the Pedal. The 16-feet Unison stops are the most indispensable, because their tone forms the true basis of the Pedal tone. Of scarcely less importance are the 8-feet, or Octave, stops. When there is a choice of stops of this latter size, the Pedal can then, in soft playing, be freely used without there existing any necessity for coupling either of the Manuals thereto to produce a good effect. The left hand, moreover, will not then be constantly deceived by descending on a key that is already down, or the melodic progression of a tenor part be broken from the same cause. If these stops cannot be introduced, or not in sufficient proportion, an "octave coupler" to the Pedal stops should be introduced.

1100. With regard to the proportion between the 16 and 8 feet stops on the Pedal, this should, if practicable, be the same as in the Great organ. When there are 5 or 6 Pedal stops, these should include a Quint of $10\frac{2}{3}$-feet tone ; and when there are 10 Pedal stops, a double open Bass of 32-feet might be included.

CHAPTER XXXVI.

THE COMPOSITION OF THE MIXTURES.

1101. WE have now arrived at the consideration of the composition of the Mixtures; that is, of the Compound stops generally, under whatever name they may appear—as Sesquialtera, Mixture, Furniture, Cornet, &c. The subject is one of great interest and importance. So great, indeed, is the influence which the class of stops in question exercises, that, after taking the greatest care to preserve the harmonic-corroborating series of stops entire, and to secure the proper proportionate number of stops of the different sizes, it is quite in the power of incorrectly compounded Mixtures to disturb those pre-arrangements, and to qualify the perfect effect of the work. For this reason, it becomes necessary to inquire what may be the several requisites of the class of stops above named.

Why should there be breaks in a Compound stop?

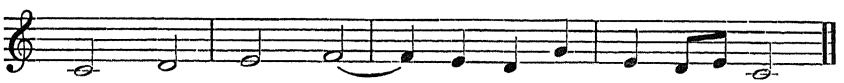
1102. The first question that presents itself is, *Why* should there be any "breaks" in a Compound stop? In the first place, because there is a practical difficulty in the way of continuing the smaller ranks throughout at the original altitude of pitch above the unison, although to do this is not impossible. It is far from easy to make pipes small enough for the purpose; and, when made, are difficult to tune, and are put out of tune again by the slightest change of temperature or by the smallest particle of dust.

A Compound stop without a break, not in accordance with the suggestions of nature.

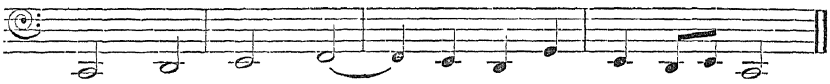
1103. Moreover, there exists no *necessity* for continuing a Compound stop up without a break. The Mixtures are intended to *corroborate* certain of the higher harmonic sounds. But these sounds are not heard to rise to so great an altitude when the fundamental tone is higher up in the scale as when it is lower down. So long a series of harmonic sounds will not be traced rising above the middle c^1 as from the CC string of a pianoforte. To continue a Compound stop throughout would be to "corroborate" what cannot be heard.

The same Compound not productive of the same effect in different parts of the scale.

1104. Furthermore, there is a very important practical fact, connected with the sound of the small stops of an organ, that should be here mentioned. It is no other than this: that the same combination or compound does *not* produce the same effect in different parts of the scale, but possesses more prominence in the upper than in the lower part. For example, if the Great organ stops, as far as the Fifteenth, be drawn, and this, or any similar passage, be played in the Treble,



a certain completeness of effect will be produced that will be satisfactory to the ear. Repeat the progression in the Bass,



and an equally perfect effect will not be experienced. The Mutation sound (Twelfth) will appear to be stronger than before; and, besides this, there will be a sensation of dulness as compared with the effect resulting from the previous experiment. If there be a III. rank Sesquialtera, and that stop now be drawn, on repeating the same low notes, the Bass will be found to be brightened up, and the Twelfth tone to be covered. If, however, the treble of the added stop be of *the same* composition as the lower part, and the foregoing passage be repeated in the higher part, the treble will again appear to be in *advance* of the Bass, in regard to comparative brightness. These facts clearly show that there is a close connection between the extent of the audible harmonic series of sounds in nature and the good effect of the harmonic corroborating stops, when of approximate range. It is evident, moreover, from their works, that the old English builders were aware of this, and that they worked accordingly, so far as circumstances permitted.

Might not a rank "die out," instead of presenting a break?

1105. The second question is, Might not a rank, as its continuation becomes unadvisable or impracticable, be allowed to "die out?" No. For, in that case, the Treble, from having fewer pipes, would sound weaker than the Bass, and consequently would be overpowered by it. To prevent this, the same number of ranks should be maintained throughout; and, when it becomes advisable to discontinue a rank at its original altitude of pitch above the fundamental sound, a duplication of some larger rank should be introduced in its stead; which, by strengthening one of the most important *remaining* tones, will add fresh energy to that tone, and so compensate for the loss of *extent* in the harmonic series.

The valuable aid rendered to the Treble of an organ by the return ranks.

1106. These duplications, introduced where the breaks occur, and increasing as the harmonic series decreases, perform a most important and valuable office when rightly managed. It has already been mentioned more than once in the course of this work that there is always a tendency in organ stops to become weaker and of lighter tone in the Treble than in the Bass. The duplications in question offer one means for almost entirely removing this defect from organs of average dimensions, which they do by presenting a great accession of tone to the ranks that are "repeated." These advantageous duplications, of course, alter the proportions as to the number of stops and ranks of different sizes *in the Treble*, which modification takes place without any detriment, but, on the contrary, improvement, to the general effect. The two chief rules to be observed in regard to the Treble are (1) that, of the Foundation ranks, those of a smaller size shall never *exceed* those of a larger, as more Fifteenths than Principals; and (2) that those of a Mutation rank must not be greater than those of the Foundation rank next below, as more Twelfths than Principals, or more Nineteenths than Fifteenths, &c. The more nearly the return ranks present a general duplication of the entire Treble, the

better. The reinforced Treble then more nearly matches in strength the brighter Bass.

On what keys the breaks had better take place.

1107. The breaks, then, being not only unavoidable, but even *advantageous* when judiciously managed, the next question is, On what keys had they better be made? For these changes no fixed positions were recognised by the old builders, nor have any been uniformly adopted by the modern. They are met with on c, c sharp, f, f sharp, and g, in different organs. In the following plans for Compound stops they occur chiefly on c sharp and g sharp.

Where the broken ranks should return to.

1108. The next point to be considered is, Where should the broken ranks return to? Seidel says, "In the repetition of a Mixture, Fifths and Octaves must be used alternately." This refers to the Compound stops of many modern Continental organs tuned on equal temperament, in which there are no Tierces, and is the best arrangement. Smith sometimes broke his Mixtures by Octaves in the bass, and used Fifths, Thirds, and Octaves successively in the Treble; England and Green more frequently used Fifths as well as Octaves for the breaks in the Bass, and Fifths, Thirds, and Octaves alternately in the Treble. But, in whatever way the breaks be made, the consequent duplication should be introduced with the view of preserving the predominance of the Foundation tone and the subordination of the Mutation.

1109. These precautions were not uniformly taken; hence certain misproportions will sometimes be met with in the old Mixtures of even some of the best builders. For example, in some old organs there will be found in the Tenor octave, to three Unison Flue stops, one Principal and *two* Twelfths, the Fifth-sounding ranks being in consequence more numerous than the Octave-sounding ranks the next below them in pitch; and from middle c^1 upwards to two Principals, three Twelfths and one Fifteenth—the misproportion being thus increased. When the sound of the Mutation ranks is strengthened beyond the necessary degree, it then no longer simply gives roundness to the tone, but imparts a slightly nasal quality to it that has nothing to do with the production of the peculiarly rich and musical effect that so frequently distinguishes the old Mixtures, but, on the contrary, to some extent it deteriorates it.

1110. In one organ the writer examined not very long since there were, in the treble of the Great organ, to

1 Open Diapason—2 Principals—3 Twelfths—4 Fifteenths.

The tone was extremely bright, on account of the Fifteenths being so much more numerous than the Principals and Diapasons; but the fundamental sound was far from being properly maintained. In another there were, to

3 Principals—2 Twelfths—2 Fifteenths—3 Tierces—4 Nineteenths.

In this case, the "Chorus" was anything but brilliant, although there was a great quantity of it, on account of the Tierces and Nineteenths being more numerous than the octave sounds immediately above and below them. On the Mixtures last referred to being subsequently revised, and the Foundation and Mutation ranks brought into better proportion, their power and clearness were considerably increased without a single rank being added to the original number.

Plans for Compound stops.

1111. Some compositions for Mixtures will now be given, in the preparation of which special care has been taken to guard against the appearance of any of the misproportions already alluded to. Advantage has also been taken of a personal examination of some of the finest English and Continental Mixtures, the best points in which have been freely incorporated, so far as the proposed number of ranks would in each case allow. As, however, two Mixtures of even the same number of ranks will produce a very different effect according to their composition, scale, and strength of voicing, the one giving a sharp and clear tone, the other a full and bold tone, the terms "Full Mixture" and "Sharp Mixture" have been used, after the German manner. The term "Mixture" has also been applied alike to all the Compounds; for which, however, any other name would, of course, be substituted that might be preferred.

1112. The first kind of Compound stop that is required for a small organ is one that will brighten up the Bass and Tenor, and add fulness, body, and firmness, to the Treble, without, however, imparting sharpness or keenness thereto. The kind of stop that is usually proposed for this purpose is a 3-rank Sesquialtera, consisting of 17—19—22 in the Bass and Tenor octaves; and 12—15—17 from Middle c^1 upwards. Almost the only fault to be found with this composition is that it places two Twelfths to one Principal in the Treble. This misproportion would be entirely removed by arranging the composition thus :—

I. COMPOSITION FOR A FULL MIXTURE OF III. RANKS.

Key on Manual.	Intervals in relation to the Unison.		The corresponding sounds in Tablature.
CC to middle c	15—19—22	———	c^1—g^1—c^2.
Middle $c^1\sharp$ to the top .	8—12—15	———	c^2—g^2—c^3.

1113. This alteration is effected entirely by substituting some other rank for the Tierce, which is not required where equal temperament is adopted. The advantages presented by the *substituted* rank are that the Fifteenth gives increased clearness to the Bass and the Principal fulness to the Treble.

1114. The goodness of a Mixture composition depends, as already explained, on the extent to which the predominance of the Foundation tone and the rules of proportion are preserved, when its ranks are added to the other Flue stops of the same Manual. Let the above composition, then, be tested in this manner. Suppose it to be added to a small organ, such as that proposed as the First Specification immediately preceding the Appendix. The proportion to the size of the stops as there given is as follows :—

3 Unisons—2 Octaves, 1 Twelfth, and 1 Super-octave throughout.

With the above addition, it would stand thus :—

From CC to Middle c^1 . . . . 3 Unisons—2 Octaves—1 Twelfth—2 Super-octaves—19 and 22; and

From Middle $c^1\sharp$ to the top . . . 3 Unisons—3 Octaves—2 Twelfths—2 Super-octaves.

1115. For a somewhat larger organ, such as Specification No. IV., a IV. rank Mixture would be required. This might be of the following compound :—

II. COMPOSITION FOR A CLEAR MIXTURE OF IV. RANKS.

Key on Manual.	Intervals in relation to the Unison.		The corresponding sounds in Tablature.
CC to Fiddle g	19—22—26—29	———	g^1 —c^2 —g^2 —c^3.
Fiddle g♯ to Middle c^1 .	15—19—22—26	———	g♯—d♯—g♯—d♯.
Middle c^1♯ to Treble c^2 .	12—15—19—22	———	g^2♯—c^2♯—g^3♯—c^4♯.
Treble c^2♯ to the top . .	1— 8—12—15	———	c^2♯—c^3♯—g^3♯—c^4♯.

1116. The duplication of the four principal ranks of the organ from Treble c^2♯ upwards (an octave and a half) imparts great breadth and dignity to the upper part of the Manual.

1117. If a keener tone should be required, the compound might have the following form :—

III. COMPOSITION FOR A SHARP MIXTURE OF IV. RANKS.

Key on Manual.	Intervals in relation to the Unison.		The corresponding sounds in Tablature.
CC to Middle c^1 . . .	19—22—26—29	———	g^1 —c^2 —g^2 —c^3.
Middle c^1♯ to Treble f^2 .	12—15—19—22	———	g^2♯—c^3♯—g^3♯—c^4♯.
Treble f^2♯ to b^2 above .	8—12—15—19	———	f^3♯—c^4♯—f^4♯—c^5♯.
c^3 in alt to the top . . .	1— 8—12—15	———	c^3 —c^4 —g^4 —c^5.

1118. As compared with the preceding composition, the above presents a *twofold* contrast from Treble c^2 to b^2 in alt—nearly a complete octave. In the first half of that octave it has a 19 and 22 in place of the Open Diapason and Principal ranks before proposed ; and in the second half octave, nearly, it has a 19 in lieu of the Open Diapason.

1119. The 29 is continued unbroken through the Bass and Tenor octaves. The upper rank, however, might have been changed at Tenor c♯ ; and at Treble c^2♯ the 22nd might have been discontinued, leaving the 19th at top. These modifications would have caused the composition to stand thus :—

IV. COMPOSITION FOR A QUINT MIXTURE OF IV. RANKS.

Key on Manual.	Intervals in relation to the Unison.		The corresponding sounds in Tablature.
CC to Tenor c	19—22—26—29	———	g^1 —c^2 —g^2 —c^3.
Tenor c♯ to Middle c . .	15—19—22—26	———	c^2♯—g^2♯—c^3♯—g^3♯.
Middle c^1♯ to Treble b^1 .	12—15—19—22	———	g^2♯—c^3♯—g^3♯—c^4♯.
Treble c^2♯ to b^2 above .	8—12—15—19	———	c^3♯—g^3♯—c^4♯—g^4♯.
c^3 in alt to the top . .	1— 8—12—15	———	c^3 —c^4 —g^4 —c^5.

1120. A break here occurs on every c♯ key throughout the scale ; and the octaves and fifths are discontinued alternately, after the manner proposed by Seidel. The changes are therefore very gradual. In some respects this composition resembles that frequently adopted by England, who was very partial to the 26th as the top rank in the Tenor octave, and sometimes in the Bass octave also. In connection with the discontinuance of the Octave Fifteenth at Treble c^2♯, it may be mentioned as a circumstance worthy of observation that the tone of that particular rank has a decided tendency to fall on the ear with great prominence above that note, unless it be very carefully treated and well balanced.

1121. If a very full tone be desired from the Mixture, the following composition would produce that effect :—

V. COMPOSITION FOR A FULL MIXTURE OF IV. RANKS.

Key on Manual.	Intervals in relation to the Unison.		The corresponding sounds i Tablature.
CC to Tenor c	15—19—22—26	———	c^1 —g^1 —c^2 —g^2.
Tenor c♯ to Middle c^1 .	12—15—19—22	———	g^1♯—c^2♯—g^2♯—c^3♯.
Middle c^1♯ to the top . .	1— 8—12—15	———	c^1♯—c^2♯—g^2♯—c^3♯.

1122. At Tenor c♯ this composition is exactly like that adopted by Green in the organ at Rochester Cathedral, excepting the omission of the Tierce; and the Treble is also the same as that planned by that builder for the same instrument, excepting the same omission and the substitution of the Unison rank in its stead.

1123. Let these several IV. rank Mixtures now be tried in the manner prescribed in an earlier part of this chapter. The Great organ, in Specification No. IV., would have, without the Mixture, Reed, and Double—

3 Unisons—2 Octaves—1 Twelfth—and 1 Super-octave throughout.

With the clear Mixture of IV. ranks, it would have—

From CC to Fiddle g . . . . . 3 Unisons—2 Octaves—1 Twelfth—1 Super-octave—19—22—26—and 29;

From Fiddle g♯ to Middle c^1 . . 3 Unisons—2 Octaves—1 Twelfth—2 Super-octaves—19—22—and 26;

From Middle c^1♯ to Treble c^2 . . 3 Unisons—2 Octaves—2 Twelfths—2 Super-octaves—19—and 22; and

From Treble c^2♯ to the top . . . 4 Unisons—3 Octaves—2 Twelfths — and 2 Super-octaves.

With the Sharp Mixture of IV. ranks, it would have—

From CC to Middle c^1 . . . . 3 Unisons—2 Octaves—1 Twelfth — 1 Super-octave—19—22—26—and 29.

From Middle c^1♯ to Treble f^2 . . 3 Unisons—2 Octaves—2 Twelfths—2 Super-octaves—19—and 22.

From Treble f^2♯ to b^2 in alt . . 3 Unisons—3 Octaves—2 Twelfths—2 Super-octaves—and 19.

From c^3 in alt to the top . . . . 4 Unisons—3 Octaves—2 Twelfths — and 2 Super-octaves.

With the Quint Mixture of IV. ranks, it would have—

From CC to Tenor c . . . . . 3 Unisons—2 Octaves—1 Twelfth — 1 Super-octave—19—22—26—and 29.

From Tenor c♯ to Middle c♯ . . 3 Unisons—2 Octaves—1 Twelfth —2 Super-octaves—19—22—and 26.

From Middle c^1♯ to Treble c^2 . . 3 Unisons—2 Octaves—2 Twelfths—2 Super-octaves—19—and 22.

From Treble c^2♯ to b^2 in alt . . 3 Unisons—3 Octaves—2 Twelfths—2 Super-octaves—and 19.

From c^3 in alt to the top . . . . 4 Unisons—3 Octaves—2 Twelfths — and 2 Super-octaves.

With the full Mixture of IV. ranks, it would have—

From CC to Tenor c . . . . . 3 Unisons—2 Octaves—1 Twelfth—2 Super-octaves—19—22—and 26.

From Tenor c♯ to Middle c^1 . . 3 Unisons—2 Octaves—2 Twelfths—2 Super-octaves—19—and 22.

From Middle c^1♯ upwards . . . 4 Unisons—3 Octaves—2 Twelfths—and 2 Super-octaves.

1124. We here see that the composition of a Mixture, consisting of a specified number of ranks, may be varied in many different ways, to adapt it to special purposes, or to cause it to suit individual tastes or feelings, and yet without creating any misproportion in any one instance. For a V. rank Sharp Mixture, the following composition would answer well :—

VI. COMPOSITION FOR A SHARP MIXTURE OF V. RANKS.

Key on Manual.	Intervals in relation to the Unison.		The corresponding sounds in Tablature.
CC to Middle b . . .	15—19—22—26—29	———	c^1 —g^1 —c^2 —g^2 —c^3.
Middle c^1 to Treble f^2♯	8—12—15—19—22	———	c^2 —g^2 —c^3 —g^3 —c^4.
Treble f^2♯ to b^2 in alt.	1— 8—12—15—19	———	f^2♯—f^3♯—c^4♯—f^4♯—c^5♯.
c^3 in alt to the top . .	1— 5— 8—12—15	———	c^3 —g^3 —c^4 —g^4 —c^5.

1125. In the Bass and Tenor octaves the above composition is identical with that used by Harris in the fine organ at Doncaster, lately destroyed, excepting that a 15 is substituted for the octave Tierce. The composition from Middle c^1♯ to Treble f^2 is also the same, with the exception of the substitution of a 22nd for the Tierce. The Fifth at c^3 in alt, introduced after the manner common in German Mixtures, should be scaled and voiced as a Dulciana, when the Double is a Bourdon. It is a noteworthy fact that scarcely any of the old organs contain a 22nd in the Treble, even when there are as many as six ranks of Mixture. The writer has not met with it in the Treble of any of the organs by Smith, Harris, Snetzler, or England, that have come under his notice ; and he has only met with it in one of Green's—namely, that in St. Katherine's Church, Regent's Park—and there it stops at Treble c^2.

1126. The omission of the 22nd from the Mixture compound in the Treble of old organs, and the occasional appearance of the misproportion in that part of those instruments, seem to have arisen from three causes :—(1) the omission of Doubles, which deprived the Treble of all depth of tone, and so prevented its successfully resisting the upward-directing influence of the octave Fifteenth ; (2) the non-return of any Mixture rank to the Unison tone, which further militated against the effectual balancing of the acute rank in question ; and (3) the comparatively few intervals left to which the broken ranks could return, and which therefore were certain to be thrown out of proportion with the Unison the more they were doubled.

1127. In the organ at Newcastle-on-Tyne, built by Renatus Harris, and also in that at Halifax, by Snetzler, an Open Diapason rank, however, as well as a Principal, is comprised in the Mixture compound in the Treble.

1128. In compounding two separate Mixtures, the same attention should be paid to the preservation of the proportion in the Bass, and the regular duplication of the ranks in the Treble, that has already been bestowed on the single Mixtures.

VII. COMPOSITIONS FOR

	a Full Mixture, III. ranks,		and a Sharp Mixture, III. ranks.
CC to Middle c^1	15—19—22	———	22—26—29.
Middle $c^1\sharp$ to Treble c^2 . . .	8—12—15	———	15—19—22.
Treble $c^2\sharp$ to f^2 above . . .	1— 8—15	———	12—19—22.
Treble $f^2\sharp$ to b^2 in alt . . .	1— 8—15	———	12—15—19.
c^3 in alt to the top	1— 8—15	———	8—12—15.

1129. Although the 19 and 22 cannot be traced among nature's suggestions in the *higher* parts of the musical scale, yet those tones have a good effect in the Treble of an organ, when they are well balanced. Moreover, there are several arrangements which will aid in bringing those acute sounds into due subordination, without the two ranks which produce them being voiced weakly; as, for instance, the duplication of their octaves below, *i.e.*, of the Twelfth and Fifteenth, which will be found to occur in all the best modern Mixtures, as well as in the old; the presence of a 4-feet or second Principal rank, which, however, is met with more frequently in old organs than in modern; and more particularly the insertion of a Sub-octave sounding stop, which is always found in new organs of pretension, and never in old. These, in connection with the usual proportion of stops—as, for instance, those in Specification No. VIII.—would produce so great a body of tone that there would be little chance of the 19 and 22 predominating in the Treble octave. At Treble $c^2\sharp$, where the 22 begins to produce an effect of remarkable acuteness—a fact, no doubt, observed by Green, as he discontinued that rank on that note—an Open Diapason rank might be introduced, as suggested in the Full Mixture of the preceding composition; which, in conjunction with the Double, would certainly tame down that otherwise noisily-inclined rank.

VIII. COMPOSITIONS FOR

	a Full Mixture, III. ranks,		and a Sharp Mixture, IV. ranks.
CC to Middle c^1	15—19—22	———	19—22—26—29.
Middle $c^1\sharp$ to Treble c^2	8—12—15	———	12—15—19—22.
Treble $c^2\sharp$ to f^2 above	1— 8—15	———	12—15—19—22.
Treble $f^2\sharp$ to b^2 in alt	1— 8—15	———	8—12—15—19.
c^3 in alt to the top	1— 8—15	———	1— 8—12—15.

1130. On examining the above compounds, it will be seen that *either* of them could be used separately with the larger stops as far as the Fifteenth, according as a full or a ringing tone might be required, without any lapse appearing in the progression; while *both* could be united for a third and fuller effect, without any misproportion occurring. This idea is taken from some of the Continental Mixtures. A separate Tierce might be drawn with either of them, and thus the possible usefulness of that rank be doubled without its being repeated, which would certainly have a very disagreeable effect.

IX. COMPOSITIONS FOR

	a Full Mixture, III. and IV. ranks.		and a Sharp Mixture, V. ranks.
CC to Tenor c	15—19—22	———	15—19—22—26—29.
Tenor $c\sharp$ to Middle c^1 . .	12—15—19—22	———	15—19—22—26—29.
Middle $c^1\sharp$ to Treble f^2 .	1— 8—12—15	———	8—12—15—19—22.
Treble $f^2\sharp$ to b^2 in alt . .	1— 8—12—15	———	1— 8—12—15—19.
c^3 in alt to the top . . .	1— 8—12—15	———	1— 5— 8—12—15.

1131. It may be as well, before proceeding further, to explain why one of the most generally received names for a Compound stop, that of Sesquialtera, has not, in the foregoing schemes, been retained.

1132. The Continental Sesquialtera, from which the English stop was originally derived, is a II-rank Mutation stop, composed of a Fifth and a Third-sounding rank, the Fifth being the lowest, and the Third the highest; the two thus sounding a major sixth, as g, e^1 on the CC key. Hence the name Sesquialtera, from Sexta, a sixth. The size of the two ranks was usually $2\frac{2}{3}$ feet and $1\frac{3}{5}$ foot, which therefore corresponded exactly with the English Twelfth and Tierce. Sesquialteras of this kind will be found in the Great and Positif departments of the Rotterdam organ; also on the Choir manuals of the organs at Amsterdam, the Hague, Freiburg, &c. When the Sesquialtera consisted of 3 ranks, a Fifteenth was frequently added to the Twelfth and Tierce, making it sound g, c^1, e^1; and it was in this form that the stop was introduced by Smith and others into the *Treble* of their English organs. Sometimes the Sesquialtera consisted of IV ranks in the Treble, in which case a Principal was usually incorporated, as in Snetzler's excellent organ at St. Mary's, Nottingham. In the Tenor and Bass octaves the Third was *lower* than the Fifth-sounding rank—thus on the CC key, e^1, g^1, c^2—so that the stop was not a Sesquialtera at all, but essentially a Mixture. Occasionally Harris made a sort of *octave* Sesquialtera, consisting of 19, 22, 24—g^1, c^2, e^2—on the CC key.

1133. Another II-rank Mutation stop used frequently to be admitted into Continental organs, called a Tertian, from Tertia, a third. This consisted of an *inversion* of the two Sesquialtera ranks; that is to say, the Fifth-sounding rank was the *smallest*, and therefore the *highest* in pitch. The two ranks thus sounded a third, as e^1, g^1 on the CC key, and therefore agreed precisely with the Tierce and Larigot of English organs. A Tertian of II ranks occurs on the Great Manual of the Haarlem organ.

1134. It will be seen, however, that the two stops in question were named after the interval which their own two distinctive ranks conjointly produced, without reference to the relation in which they might stand to the fundamental tone of the organ; and in this respect they differed from all the other stops in the organ-builder's vocabulary. In fact, the Sesquialtera was, in a few cases, simply labelled "Sexta," as on the Great Manual of the organ at Mülhausen, and on the same department of that in the Church of St. Dominico, at Prague. A third stop, of II ranks originally, and mostly composed of a Twelfth and Fifteenth on one slider, used also to be frequently introduced by German organ-builders, under the name of Rausch-quint or Rausch-pfeif. This combination is still in use. To the Sesquialtera composition in the Treble many modern organ-builders and organists have taken great exception; some proposing to substitute in its stead a continuation of the 19 and 22 through the next octave and a half; thus forming a sort of III-rank Sharp Mixture, while others suggest the introduction of a Principal in place of the Tierce, after the manner of the III-rank Full Mixture already given. Both the compositions recommended remove almost every vestige of the original Sesquialtera, even from the only half of the Manual range in which it usually appeared in English organs; and on this account it becomes a subject well worthy of consideration whether the name should continue to be applied to a stop to which it is no longer in the least degree appropriate. Following the modern German custom, the name was relinquished with the composition in the plans for Mixtures just now proposed; and other names were adopted, which very simply, yet clearly, announce, even to the uninitiated, what are the distinctive properties of each, as "Full

Mixture" and "Sharp Mixture." The only deviations from the Continenta nomenclature consist in the addition of the adjective "full" to the *largest* Mixture, which appeared to be necessary, inasmuch as fulness of tone is by no means a common attribute of an English Mixture, although it is one of the leading characteristics of a German one in the Treble, and, in the addition of the word "Mixture" to that of "Sharp," to intimate that such a stop *is* a stop of that kind; a fact known sufficiently well abroad to be understood without the announcement being placed on the stop-label, but which probably would not be so at first in this country, supposing that name to be adopted.

1135. One of the chief objects for which the Sesquialtera was originally used abroad was to place a second Twelfth on the Manual of those large instruments, in which the Mixture ranks were sufficiently numerous to require it, to bind their tone more firmly to the large work of the same Manual. In the modern instruments of German builders, from which the stop in question is mostly omitted, the second Twelfth is usually incorporated with the "Full Mixture," as illustrated in the 9th Composition already given. That plan might be followed for new Mixtures; or, if the introduction of a separate and genuine Sesquialtera were desired, this would be well secured by arranging the composition after the following manner:—

X. COMPOSITIONS FOR

	a Sesquialtera, II ranks.	a Full Mixture, III and IV ranks,	and a Sharp Mixture, V ranks.
CC	12—17 . . .	15—19—22 . . .	15—19—22—26—29.
Middle $c^1\sharp$ . .	12—17 . . .	1— 8—12—15 . . .	8—12—15—19—22.
Treble $f^2\sharp$. . .	12—17 . . .	1— 8—12—15 . . .	1— 8—12—15—19.
c^3 in alt . . .	12—17 . . .	1— 8—12—15 . . .	1— 5— 8—12—15.

1136. The Tierce, or second rank of the Sesquialtera, is, in modern German organs, usually incorporated with the Sharp Mixture, and not the Full Mixture, *i.e.*, with the *second* Compound stop, and not the *first*—and for this reason: When the unequal temperament was in vogue abroad, the slightly sharpened thirds in the common scales nearly accorded with the Third-sounding rank of the Mixtures, and the latter effected a direct improvement on the general tone of the organ. On the equal temperament being adopted, and the thirds sharpened a little more, the Tierce was found to harmonise less agreeably than before; hence arose the plan of not introducing a Third-sounding rank so soon as had previously been the custom. Five ranks of Mixture thus came to be generally proposed without a Tierce; and in its stead a duplication of the Fifteenth was usually introduced, which substituted rank added materially to the distinctness and the silvery character of the Mixture sound.

1137. With regard to the incorporation of the Tierce with the Sharp Mixture, this Continental custom was not followed in the preparation of the foregoing schemes, because in England the prevailing feeling is at present more frequently in favour of the *early* use of the Tierce than not; therefore, by leaving it to be disposed as a separate stop, it could be drawn either with the first Mixture or not, according as the inclination of the organist might dictate.

1138. There is another German Compound stop, sometimes met with in large organs, that might here be noticed, called the Cymbal. This frequently consists of a duplication of the two or three upper ranks of the Sharp Mixture, with sometimes an octave Tierce added. In connection with a stop of this kind it may be mentioned that, when the Mixtures ascend very high, and are

particularly strong in the Tenor octave, there is always a danger of the Treble being overpowered and obscured by them; and it is then that Cavaillé-Coll's increasing pressure system is useful. For the Treble Reeds of large organs the heavy pressure system is often very desirable. The tendency to weakness as the scale ascends was observed by the Dutch and German builders nearly two centuries since, who proceeded to rectify it by furnishing the leading Manual stops of their organs with two pipes to a key from Middle c, Fiddle g, or even Tenor c upwards; and also by increasing the number of ranks in the upper part of the Mixtures, as at Haarlem, Rotterdam, Amsterdam, Hamburg, &c. The repetitions which occur in the Treble of the Mixture stops also exercise a material influence in that direction. The increasing pressure system attains the same end without such re-duplications. At the same time all the proportions which have already been detailed, and the duplication of all larger ranks before smaller ones, must be duly observed, otherwise it is not in the power even of a heavy wind to secure a well-balanced effect.

1139. The Cornet is a very useful stop for a large organ to contain, and it is frequently the only stop that contains a Tierce, as at Doncaster. The Cornet was originally used for giving out the melody of a chorale upon, and hence was usually only a Treble stop in English instruments; but in Germany, where the Canto Fermo is frequently announced in the Tenor, *à la* Bach, it generally descends to Tenor c, or even to CC. For a large organ the Cornet is also useful in another way. Not having any "breaks" itself, it covers up those in the other Compound stops very effectively. It is sometimes made to increase or "progress" in the number of its ranks, from two to three, and three to four, in the following manner :—

CC . . 15—17 Tenor c . . 12—15—17 Middle c^1 . . 8—12—15—17,

or it is made to consist of 8—12—15—17 from Tenor c upwards.

1140. In regard to scale, the Mounted Cornet is larger than the Open Diapason; the Principal and Twelfth ranks being three pipes larger, and the Fifteenth and Tierce two pipes larger, with narrow mouths, arched lips, and voice of a flute-like quality of tone.

1141. Herr Franz Weber, the late excellent organist of Cologne Cathedral, constantly used the Mounted Cornet as an accompaniment to the priests' voices.

1142. As the Mixtures of many of the old English builders have been so frequently referred to in the present chapter, the composition of some of them may prove interesting to many readers, and are therefore subjoined.

SMITH.

(*Temple Church.*)

	Sesquialtera, III ranks.	Mixture, III and II ranks.
CC	17—19—22	22—26—29.
Tenor c♯ . . .	17—19—22	19—22.
Middle c^1♯. . .	15—17—19	12—15.
Treble c^2♯. . .	12—15—17	12—15.
Treble f^2♯ . . .	8—12—15	12—15.

HARRIS AND BYFIELD.

(*Doncaster Church.*)

	Tierce.	Sesquialtera, V ranks.
CC to middle b . . .	17	19—22—24—26—29.
Middle c^1♯ to the top	17	8—12—15—17—19.

SNETZLER.

(*St. Mary's, Nottingham.*)

	Sesquialtera, IV ranks.
CC to Fiddle g	15—17—19—22.
Fiddle g♯	12—15—17—19.
Middle g¹♯	8—12—15—17.

GREEN.

(*Rochester Cathedral.*)

	Sesquialtera, III ranks.	Mixture, II ranks.
CC	17—19—22	15—19.
Tenor c	17—19—22	12—15.
Fiddle g	15—17—19	12—15.
Middle c² . . .	12—15—17	8—12.

GREEN.

(*St. Katherine's, Regent's Park.*)

	Sesquialtera, III ranks.	Mixture, II ranks.
CC	17—19—22	22—24.
Fiddle g	17—19—22	17—22.
Middle c¹ . . .	15—17—19	17—22.
Treble c² . . .	12—15—17	15—17.

ENGLAND.

(*Lancaster Church.*)

	Sesquialtera, IV ranks.	Mixture, II ranks.
CC	17—19—22—26	24—29.
Gamut G . .	17—19—22—26	22—24.
Tenor c . . .	17—19—22—26	12—22.
Tenor . . .	15—17—19—22	19—22.
Middle c¹ . .	8—15—17—19	15—19.
Middle f¹ .	8—12—15—17	15—19.
Treble c² . .	8—12—15—17	12—15.

The Mixture-work in the Newcastle-on-Tyne organ, made as long back as the year 1676, includes an *Open Diapason* rank in the Treble, and is of the following composition :—

NEWCASTLE-ON-TYNE MIXTURES, BY HARRIS.

	Tierce.	Sesquialtera, II ranks.	Mixture, III ranks.
CC	17	19—22	24—26—29.
Middle c¹♯ . . .	17	19—22	17—24—26.
Middle d¹	17	19—22	15—17—24.
Middle a¹	17	1— 8	15—17—24.
Treble d²	17	1— 8	12—15—17.

The chorus stops of the organ at St. Peter Mancroft, Norwich, by the same

builder, included *two* Open Diapasons, *two* Principals, and *a Quint.* The following is the scheme :—

ST. PETER MANCROFT MIXTURES, BY HARRIS.

	Tierce.	Larigot.	Sesquialtera, III ranks.	Mixture, II ranks.	Furniture, III ranks.
CC	17	19	19—22—26	29—33	22—26—29.
FF♯	17	19	19—22—26	29—33	15—19—22.
Tenor c♯	17	19	12—15—19	22—26	15—19—22.
Tenor f♯	17	19	12—15—19	22—26	8—12—15.
Middle c^1♯	17	19	8—12—15	19—22	8—12—15.
Middle f^1♯	17	19	8—12—15	19—22	1— 8—12.
Treble c^2♯	17	19	1— 5— 8	15—19	1— 8—12.

Snetzler also incorporated an Open Diapason rank in the Treble of his Mixtures at Halifax. The composition he adopted was as follows :—

HALIFAX MIXTURES, BY SNETZLER.

	Sesquialtera, IV ranks.	Furniture, III ranks.
CC	15—17—19—22	22—26—29.
Tenor c	15—17—19—22	15—19—22.
Middle c^1	8—12—15—17	15—19—22.
Middle g^1	8—12—15—17	8—12—15.
g^3 in alt	1— 8—12—15	8—12—15.

CHAPTER XXXVII.

THE EXTERIOR ARRANGEMENT OF THE ORGAN.

The organ case.

1143. THE two great desiderata in an organ case, the one referring to its appearance, the other to its influence on sound, are that it should correspond in style with the building in which it is erected, and that it should impede the egress of the tone as little as possible.

1144. The most appropriate style for a church organ case, generally speaking, is one of the periods of the Gothic; because in some one of those the great majority of our finest ecclesiastical edifices, both ancient and modern, are built. No authentic examples, however, of cases in this style of early date are known to exist in England. In Germany a few still remain. One of the most beautiful is in the "Marien-Kirche" at Lübeck, at the west end of the building. It consists of three main compartments, flat; the centre one being the largest, and containing the 32-feet tin pipe. The main compartments are separated by two subordinate ones, containing smaller pipes. All the front pipes are of pure tin, burnished, and slightly but exquisitely diapered about the mouth; and the case, of some dark wood, has a great quantity of carved and gilt work about it, which gives a gorgeous effect to the whole. Underneath it is groined, and handsomely illuminated and gilded.

1145. There was an old organ case existing in Tong Church, Shropshire, towards the end of the last century, ornamented with "tabernacle work." That at Radnor has already been described. The handsome old cases at Exeter, Shrewsbury, and Cambridge, are Italian in their detail. So also are those made by Smith and Harris immediately after the Restoration. Literal copies of these are therefore unsuitable for churches of pointed design, even though the originals may stand in buildings erected in that style. Nevertheless, many of the specimens just referred to possess an air of great dignity, as well as considerable beauty and elegance of outline. Their various compartments are often very finely proportioned, while their relative sizes have been adjusted to each other with consummate judgment and taste. In most of the old organs the largest pipes of the original work—*i.e.*, the lower pipes of the Open Diapason—are almost always found in the front of the case, in the towers. They were originally placed there for two reasons: (1) to impart dignity to the general appearance of the instrument, and (2) to secure for them plenty of speaking room. The larger the pipe, the greater is the gust of wind emitted from its mouth; and, consequently, the more space must there be in the vicinity of the mouth to admit of the pipe speaking clearly and firmly. By mounting the large pipes in the manner already noticed, they not only had plenty of this necessary room, but, from the direction in which their mouths were turned, they could produce their sounds freely, without encroaching on the speaking room inside the case necessary to ensure the correct enunciation of the interior pipe-work.

1146. In some modern organs the case has been made with carved woodwork in front, instead of pipes, giving the instrument a "shrine-like appearance,"

If a case of this kind is proposed—although it is not clear what may be the merit of making an organ look like what it is not—additional space should be allowed inside for the accommodation of the dismounted pipes; for if one pipe be placed too near to the back or side of a second, so that its mouth becomes shaded, the tone of the former will become muffled and flattened in pitch, or if the mouth of one pipe be placed so near to that of a second that when both are made to speak the current of air emitted from the one intersects that from the other, the tone will be false and tremulous. The organ-builder's greatest care is required to guard against the appearance of these casualties, even when circumstances are most favourable; but when standing and speaking room have to be found inside for several additional and large pipes, without the necessary extra space being allowed internally, the organ-builder's difficulties and the chances of the tone of the organ being unequal are needlessly and vexatiously increased.

1147. The principle of arranging large pipes with their mouths turned outwards has in several instances been carried farther by the modern organ-builders than by their predecessors, and with equally good results. The Pedal organ is usually planted either at the back of the instrument, or it is divided into two portions, and a part arranged at each side of the organ, just inside the case. When there is sufficient clear space outside the organ case in the vicinity of the Pedal organ, the larger pipes of that department are often turned round and made to speak through openings or gratings in the case made for the purpose, as at Christ Church, Newgate Street; St. Olave's, Southwark; St. Peter's, Cornhill, &c. This plan is a very good one, not only because it prevents the possibility of the tone from the large pipes being smothered and uncertain, but also because it admits of some of the other inside pipes being planted close to them, back to back, as at St. Olave's, Southwark, whereby a great saving of room is effected.

1148. In a few instances the organ case has been made with metal pipes at both sides, as well as in front, as in the instrument recently destroyed at Croydon Church, built by Avery, in 1794, and also in that at St. Katherine's Church, Regent's Park, by Green. Organs on a central screen mostly have an east and west front, not simply for ornament, but to allow the tone to travel up and down the building.

1149. It would greatly add to the beautiful appearance of the organ, as well as be beneficial to the quality of some of its tones, if the front pipes were to be made of pure tin, and the natural lustre of the material to be left unobscured, instead of their being formed of an inferior compound, and then gilded or painted. This improvement might be the more easily effected, since the sum necessary to defray the cost of gilding, &c., added to the value of the metal pipes of lower standard, would probably go some way towards securing substantial pipes of the more handsome and durable material. Moreover, the bright metal pipes, by catching and throwing back the rays of light, after the manner of a reflector, would relieve the appearance of the organ from some of the dulness it wears in the dismal holes and corners to which it is too frequently consigned.

The Manuals and Pedals; their width, and their proper situation in regard to each other.

1150. The width for a Manual that ranges from CC to f^3 in alt (54 keys) is 2 feet 6 inches. For the Pedal board there is in England at present no fixed width, which is a circumstance much to be regretted. On this subject Dr. Burney wrote, eighty years ago :—"Scarcely two organs in the kingdom have their Pedals alike, either with respect to number or position; so that every performer who comes to an organ with which he is not previously acquainted (be he ever so skilful in the use of

Pedals) has the whole of his business to learn again." The want of uniformit complained of by Dr. Burney as existing in his time remains in full force in th present day.

1151. The natural Pedal keys should, if possible, be a good inch in thickness about 20 inches in length, and from 2 to $2\frac{1}{2}$ inches in depth. If they are either to narrow, too long, or too shallow, they will have a tendency to spring. Their uppe surface should not be much rounded off towards the sides, as in that case the foo would only touch the crown of the Pedal. The angles, however, would of cours be bevelled off, to remove splinters, &c. The upper surface is sometimes rounde to assist the foot in slipping from one Pedal to the next; but this is reversing the order of things. The Pedal should be constructed to *retain* the foot steadil and firmly. It is the organist's province to be able to change from one Pedal t its neighbour with facility when necessary.

1152. The two great points to be observed in the construction of a gooc Pedal board are that space should be economised, as far as practicable, in orde that as complete a compass as possible may be secured, and yet that the Pedals be not placed so closely that they can only be made of the thickness of mere sticks.

1153. A good medium scale is obtained by planting the Pedals so that the naturals measure $2\frac{3}{8}$ inches from centre to centre. This is about the scale adopted by Mr. Hill, among other builders, and it admits of the introduction of a complete compass of Pedals without throwing the upper keys so much to the right as to be out of reach of the performer. In Germany the Pedals usually measure as much as from $3\frac{1}{8}$ to $3\frac{1}{4}$ inches from centre to centre, while in England they are as frequently placed too closely together.

1154. The Pedals are more agreeable to play upon when the naturals are about half an inch higher at the back (under the stool) than at the other end; then the heel of the foot sooner reaches the key. The upper part of the short Pedal keys, which need not be more than five inches in length, are also the better for not being quite level. They should slightly incline upwards as they recede, leaving the front or lowest part about an inch above the neighbouring part of the naturals. When so shaped they meet the point of the foot more accurately. A frame should run across beyond the short Pedal keys, to serve as a foot rest, but *not* at the sides, as it would be in the way of the extreme keys.

1155. Several experiments have at various times been made with the view of bringing the Pedals more conveniently under the control of the performer. In the organ at York Cathedral, erected in 1829, Mr. Hill made the Pedal board on the radiating principle. In Germany the Pedal board is frequently made concave in shape, *i.e.*, the Pedals to the extreme right and left are made to rise gradually in a curve. This was the case with Schulze's organ in the Great Exhibition of 1851.

1156. Lately, Willis of London and Heinrich of Cologne have been making Pedal boards in which it has been the object to combine the peculiarities of the radiating with the concave principle. Indeed, most of the English organ-builders now occasionally make "concave and radiating" pedal-boards.

1157. The Manual keys should not be too short in front of the centre, otherwise the touch will be too shallow and too heavy. On the other hand, they should not be too long, otherwise the touch will be too deep, and most likely also destitute of firmness. About $\frac{3}{8}$ of an inch is the proper depth for the Great organ keys to fall; and all the Manuals should descend to the same depth. The performer, nevertheless, soon accommodates himself, for ordinary purposes, to a rather deeper or slightly more shallow touch than the average one, or even to one that is a degree heavier or lighter than usual,

The condition of the greatest importance to him is that, whatever be the general depth and resistance, all the keys on a Manual shall be *alike in both these respects*. If one key requires more power than its neighbours to press it down, or descends lower, or not so low, the playing is rendered more difficult by such vexatious inequalities. Check-springs, put on by a lazy attendant to save a little trouble, are a prolific source of unequal resistance.

1158. A springy resistance of greater or less amount, according to circumstances, is all that the finger or foot should have to overcome. Unequal, stiff, or sluggish touches are all defective. A little allowance, however, may fairly be made in favour of lately renovated or newly constructed organs. In new mechanism of all kinds there will be a little friction at first, in proportion to the accuracy with which it is made ; and the mechanism of an organ offers no exception to the rule. If the key movement works "too easy" at first, it may rattle after a few years' use.

1159. When the Manual couplers are drawn, the resistance offered by the chief Manual to the finger will, of course, be increased. The touch, however, should still preserve its *elasticity*. Sometimes a very disagreeable grating sensation is experienced by the finger, as though the coupler stickers were working through scouring paper.

1160. With regard to the arrangement of the Manuals, the best and most generally received plan is that of placing the one belonging to the Great organ in the middle, with that of the Swell three inches above, and that of the Choir as many inches below. Sometimes, to lessen the distance to which the upper Manuals recede behind the lower, the front of the Great organ keys is made to project over those of the Choir about an inch and a half, and those of the Swell to stand forward in the same manner and to the same distance over the Great organ keys. There are two ways of doing this : either by making the beading in the front of the keys take the form of an ogee projection, or by bevelling away the under side of the key, upwards, commencing about an inch from the front, as in the Birmingham and St. Paul's organs, &c. The latter plan is the best, as the hands can then be raised from one Manual to the next without danger of striking the knuckles.

1161. Thirty-one inches below the Great organ Manual is a convenient position for the Pedals. The centre C of the Pedals—that is, the middle one of the three bearing that name—should be planted immediately underneath the middle c^1 of the Manuals ; and the front of the short keys should come just under the front of the Great Manual short or black keys.

1162. In many organs the Pedals are placed too far from the Manuals, and often also too forward. The organist should be able to use either of the three Manuals or the Pedals freely, without experiencing the slightest tendency to fall from the seat. This firmness of location and command over the instrument will be secured if (1) the Pedals are placed at twenty-eight inches from the Choir Manual, with the front of the short keys placed as already described ; (2) if the stool be arranged at a distance of twenty-two inches above the Pedals ; and (3) if the stool be placed about six inches in front of the Choir Manual.

1163. When seated at the organ, the feet should be suspended immediately in front of the short Pedals. If, when seated at a distance of twenty-two inches above the Pedals, the Manuals appear too high ; or if, on increasing the height of the stool, so as to bring the Manuals more under command, the feet are too far from the Pedals, it is a proof that the Pedals are at too great a distance from the Manuals. If, after placing the organ stool in such a position as will allow of the free use of the Pedals, the Manuals are too far off, and if, on adjusting it so that

the Manuals are within convenient reach, the feet hang over the short Pedals—this shows that the Pedal board is too forward.

The organ stool. 1164. It adds much to the comfort of playing if the top of the organ stool be made of a good width, as it enables the player to sit with more firmness at the instrument. For this purpose it should be made about fourteen inches in width, and should *not* incline downwards towards the front, as this has a tendency to make the player slip forward when actively employed. For the same reason it is better not to cover the seat with a smooth substance, as certain kinds of leather or horse-hair cloth; but simply with either a piece of carpet, or with rough leather, with a *little* stuffing. The plain wood is often left for the top. In such case it is much better for it not to be polished.

1165. In the top of the stool one or two drawers can be conveniently introduced, which are always useful to hold music or books. A rail across under the stool, from end to end, about four inches above the Pedals, and five or six inches from the front, will be found a great convenience for resting the feet upon, as the frame under the composition Pedals is too far off for constant use.

The Swell Pedal. 1166. The Swell Pedal is not at all times conveniently placed, it frequently being too high and too forward. About seven inches above the Pedal board will be found a very convenient position for it. Sometimes it is so arranged that, when the Swell is fixed open, it *crosses* the upper short keys of the Pedals. This, of course, is not good. It might conveniently be made to project parallel with the composition Pedals, so as to meet the foot, instead of through the jamb, and in such a position that, when fixed down, it would lie over some place where two naturals come together; as, for instance, over the upper e and f of the Pedals. On fixing open the Swell, it would then be far less in the way of the Pedals than it frequently is when it projects from the side.

1167. When the Swell Pedal projects from the side, and the leg has to be turned out so much before the Pedal can be got at that the position of the body at the keys becomes disturbed, it is a proof that the Pedal is too forward. If the thigh-joint as well as the foot have to be raised before reaching the Pedal, it is an indication that the latter is too high. Sometimes the organist has to throw his body backwards in order to preserve his equilibrium, or to place his thumbs on the beading in front of the keys to prevent his falling forward. Either inconvenience is the consequence of some misarrangement in the region of the keys. Either the Swell Pedal will prove to be too high or too forward, or the stool or Pedals will be too low or too forward.

The music desk. 1168. It is a matter of great convenience to have the music desk properly adjusted. When there are three Manuals, the desk should not be farther back than the *front* of the Swell keys, and it may be placed nearly as forward as the front of the Great Manual. It is a great fault if the desk is placed at the back of the Swell keys, as, from this cause, the music is needlessly carried five or six inches farther from the organist than there is any occasion for, and nearly as much too low also, thus rendering it necessary that he should look *down upon* the music, instead of *forward at* it.

The Composition Pedals. 1169. The Composition movement should be of the "double-action" kind. The Pedals which operate upon them are sometimes made to project in a line with, and just above, the German Pedals; at other

times from the sides, like so many long Swell pedals. The former is not only the most neat, but the most convenient arrangement. It is a good plan to place the Composition pedals immediately over where two naturals come together, as there is then no chance of the heel touching a short key when either of them is being pressed down, or they can be kept up a little higher to prevent this accident. The Composition pedals should not remain down so as to be in the way of the short pedal keys.

The arrangement of the draw stops.

1170. The draw stops should be so placed that they will not only be under the convenient control of the player, but also present a handsome and symmetrical appearance.

1171. In many of the old English organs half the stops belonging to each department are arranged on each side of the Manuals. A great number of the German and other Continental organs also have their stops assorted in a similar manner. The plan, however, is not by any means a good one, as it apportions the stops into twice as many divisions as there is any occasion for, without serving any beneficial result.

1172. A far better arrangement is the modern English one of placing all the stops of each department together, as the contents of each division can then be so much more easily distinguished from the rest.

1173. Besides keeping them separate, as above, the stops of each department should further be placed where they can be combined or changed with the least difficulty to the performer. With a view to the attainment of this end, it is important to bear in mind the two following facts: (1) that, as a rule, the left hand can be more easily spared for a moment than the right; and (2) that the Great organ stops are more frequently brought under the control of the feet of the performer by means of Composition pedals than those of any other department.

1174. The right-hand side is therefore the best side on which to place the Great organ draw stops, as they can be drawn in or out, in all the ordinary and most frequently required combinations, without any assistance whatever from the hand.

1175. The Swell and Choir organ stops are not nearly so often acted upon by Composition pedals. Moreover, as the numerous delicate shades and varieties of tone are produced from those departments chiefly, leaving the Great organ for the broad contrasts, the left side appears the most proper one whereon to place their draw stops. As the bass part of the music can be continued by the pedals, the left hand can, with a little contriving, be for a moment spared for effecting the necessary changes in the combinations, without in the least degree disturbing the progress or completeness of the music.

1176. The Pedal organ stops and the various *Manual* couplers might be placed on the right-hand side, with a view to securing as nearly as possible an equal number of stops on both sides of the keys, which is always desirable. But the *Pedal* couplers should, whenever practicable, be ranged on the left-hand side, to facilitate the making of those quick changes from one Manual to another that are so constantly required in accompanying the musical service, as well as in solo playing.

1177. If there is a large Pedal organ, it will be advisable to have some contrivance for reducing the full Pedal organ to a few 16 and 8 feet Flue stops of soft intonation, to form a Pedal bass to the Choir or Swell. This can either be a Composition Pedal, or, by placing all the louder stops on a second sound-board, and introducing a valve into the second wind-trunk—as is ordinarily

done in small English organs which have only "Pedal pipes" by way of Bass—they can then be silenced by shutting off the wind. A third plan would be to have a movement, worked by the hand or foot, to disconnect the action of the loud-stop sound-board from the Pedal. If a "Ventil" be introduced, and it be intended to work it by the hand, the handle should be placed near to the Great Pedal coupler, that both may be changed together.

1178. In arranging the places for the several stops of any one department, it is best, first, to keep the Reed and the Flue stops quite separate. The Reed stops should be placed above, and the Flue stops below.

1179. Next, the members of the different classes of stops should be arranged according to their standard length or their size of tone, giving to the largest the lowest positions, and the smallest the highest. According to this rule, all the Flue stops of 16 feet on the Manual, as being usually the largest, should occur at the bottom, with those of 8 feet next, and so on through the series in regular gradation. And the same with the Reeds. The disposition of even a large organ may soon be learnt, as well as the places where the several draw stops are to be found, when the latter are arranged in a methodical and intelligible manner. As an example, the size and comparative completeness of any of the German organs described in the Appendix may at once be ascertained from a perusal of the list of its contents arranged in the simple manner there given.

1180. The several draw stops are generally arranged in single, double, or triple *vertical* rows on each side of the Manuals, according to their number and the size of the organ. The draw stops of the organ in Cologne Cathedral are arranged in four *horizontal* rows, and so are those of many other Continental organs. At Westminster Abbey the draw stops are also placed in this manner. Regarding the best method of distinguishing such draw stops as belong to one department from the remainder, this matter must necessarily depend in some measure on individual circumstances.

1181. In small organs of two Manuals the Great and Swell stops are generally arranged so as to form each a separate row—one on the right, the other on the left. An ivory or brass plate inserted above each row, bearing the name of the clavier to which that tier belongs, is, in that case, all that is required to mark the requisite distinction. This plan of identifying the draw stops with the clavier to which they belong is far preferable to that of crowding such announcement on every individual stop handle, in addition to the name. The less there is engraved on the knob, besides the name and length of the stop, the better. What *is* engraved not only then appears more distinct, but there is room to cut it in a bolder and more legible type.

1182. If the draw stops are intended to be placed in double rows, it will be found a convenient arrangement to let the Swell stops comprise one portion of the two tiers on the left-hand side, and those of the Choir the remainder. The list of contents of each department is then brought within much more convenient range of the eye than when extended over a long tier of draw stops. In that case the Swell stops should occupy the upper position, and the Choir the lower. This arrangement also presents an analogy with the situation of the respective Manuals.

1183. When the draw stops are numerous, they are frequently arranged in triple instead of double rows. This plan is a good one, as it prevents the tiers becoming inordinately long, and, therefore, keeps the upper draw stops more within reach. The best method of then classifying the stops is to make those belonging to one department occupy the upper portion of the three rows, and

those of another, the lower. A little extra space, if possible, left where those of one clavier leave off, and those of another begin, in addition to the engraved plate, will be found most advantageous in making the point of separation more distinct.

1184. Other means are sometimes taken, in addition to those already mentioned, for distinguishing the draw stops of each department. Thus, in addition to their being arranged in tiers or in clusters, the ivory plates in the face of the stop handles of some of the departments are sometimes stained red, blue, green, or some other colour. If colours be used, for which there is no absolute occasion, they should be of the lightest possible tint, or they will render the inscriptions indistinct. Different substances are also occasionally used for the name plates, for increasing the distinction; as ivory for those of one department, mother-of-pearl for a second, porcelain for a third, tortoise-shell for a fourth, and so on. These, however, give to the general appearance of the draw stops a motley effect, as the colours, if deep, give them a heavy and patchy appearance. Another plan is to have the names of one department on each side printed in black, and the other in red. This has a light and handsome effect, particularly when the character chosen is the old church text. The red-lettered labels should be above, and the black below. Every stop should have its name engraved on the handle, in preference to being placed over or at the side of it; as this prevents the possibility of the inscription being by mistake read as referring to any other than the right draw stop. The names are sometimes engraved on plates of zinc or brass, and inlaid; but those metals soon become tarnished. Many organs have the names of the stops printed on pieces of paper, which are pasted on, near to the handles; but such labels are apt to become soiled or rubbed off, and at the best present but a mean appearance.

1185. The head of each stop-handle is usually turned out, and a plate of ivory or some other bright material inserted, bearing the requisite inscription.

1186. The inscriptions should be engraved boldly and legibly. For this reason, italics with long flourishing tails to the g's, &c., should be avoided, as not being so easily deciphered. Capital letters are the most appropriate; and those of the Egyptian, German, Old English, or modern English character are available according to taste. Old English text for the names has a handsome appearance, and is particularly appropriate for church organs. It is better to have the names engraved in horizontal lines rather than in a circle, following the outline of the plate. It is then deciphered more easily and more quickly.

1187. In connection with the question of distinctness of labelling, it may not be out of place to mention that the person who plans the organ will most probably have also to decide on the nomenclature for the stops. When settling this by no means unimportant matter, it will be well to bear in mind the purpose for which the labelling is introduced; namely, to *assist* and *guide* the player. To carry out this object, the labels should describe in as simple and clear a manner as possible the stops to which they apply. And to facilitate this end, names in English would appear to be clearly the best for English organs, whenever they are applicable. Sometimes, however, it is preferred to call the stops after some Continental fashion. When this is done, care should be taken to apply the names, so that an organist or organ-builder from the country whence the terms are derived shall understand them. This necessary precaution has not always been attended to.

1188. It is of importance that the draw stops should move with freedom and noiselessly. A stiff and stunted draw-stop action is most disagreeable. If, however, the table of the sound-board is covered with leather, *i.e.*, if the

sliders work upon leather—they will move rather stiffly at first, until the leather has become tolerably smooth, for which stiffness some allowance should be made.

1189. From $2\frac{1}{2}$ to 3 inches is a good distance for the draw stops to move backwards and forwards.

1190. The draw stops, which are better for being of a good medium size, should not be placed too closely together. If the knobs are $1\frac{1}{2}$ inch in diameter, with ivory plates $1\frac{1}{8}$ inch wide, and have the inscriptions cut in letters $\frac{3}{16}$ of an inch high, they will have a bold and handsome appearance.

CHAPTER XXXVIII.

THE INTERIOR ARRANGEMENT OF THE ORGAN.

The building frame.

1191. The building frame that is to support the entire organ should be very strong and substantial, and should be so constructed as to resist the great weight and pressure of the sound-boards and pipes without sinking or giving in any manner.

The platform.

1192. It is not a less important and necessary precaution to see that the platform—when the organ is to stand on one—is not only fully capable of supporting the entire weight of the instrument, but also that of any assembly that may be gathered around it from time to time, as the members of an orchestra and chorus in a concert-room, or the choir and children in the gallery of the church. Instances are known where this preventive course has not been sufficiently taken in music-halls, the consequence being that, while the organ is entirely free from cipherings and stickings at all other times, during concerts it is subject to both.

1193. With regard to the general arrangement of the interior of an organ, the sound-boards and other main portions of the work would be distributed chiefly according to local circumstances.

The distribution of the sound-boards.

1194. The most usual positions assigned to the different sound-boards in English organs were mentioned on page 4, and need not, therefore, be again described here.

1195. In some German organs, occupying a very broad, high, and shallow site, the "8-feet Great organ" (*Haupt-manual*) is placed in the centre, with the "4-feet Choir" above (*Ober-manual*), and the "16-feet Pedal" half on each side; the largest pipes of the "Principal" of each department, 8, 4, and 16 feet, being placed in the front of the case.

1196. In the organ of St. Peter's Church, Cornhill, built by Hill, the large Swell is placed over the Great organ, resembling in this respect the arrangement just mentioned; and when a church is very lofty, or an organ is to stand at a great elevation above the ground, the Swell may be placed in this manner without producing any disadvantageous effect, but rather the reverse, provided it be kept well up at the same time. The under side of the Swell sound-board then acts as a sort of reflector to the Great organ, and directs its tone into the church before it is too much spent. The old English builders frequently put a top or covering to the case of their cathedral organs for the above-named purpose, as at St. Paul's Cathedral.

1197. In other German organs, where the site is about the same width as before, but lower and deeper, the Choir organ is placed in the centre, with the Great organ, divided, flanking it on each side, and the Pedal behind. The object in placing the Great organ partly on each side, rather than in the centre, no doubt, was to prevent its force being too sensibly felt at the keys. Other plans were sometimes adopted

by the old English builders for shielding the organist from the full strength of the instrument; such as keeping the impost of the case high, or placing a passage board completely across the front, between the Great organ sound-board and the front pipes, as was originally the case at St. Michael's, Cornhill. When there are three Manuals, the third Manual organ is frequently placed "in front," as it is termed in England, but "at back," as they say in Germany, where that division is hence called *Ruckpositiv* (Back-choir). In very large instruments the Pedal organ frequently occupies three separate sites, forming what are called "side Pedal Basses" and "back Pedal Basses," an English example of which arrangement will be found in Mr. Hill's organ in St. Paul's Cathedral; or, where the largest metal "Principals" appear in front of the case, a fourfold division of the Pedal will sometimes be met with, forming "front Pedal Basses," "back Pedal Basses," and "side Pedal Basses." Of this latter distribution, an English example occurs in the Town Hall organ at Birmingham, by Hill.

1198. These particulars are given here to show that an organ may be made to suit almost any site, provided only that the necessary room be allowed in some direction or other.

The cause of the bad proportions of many English organs.

1199. English organs have frequently been found fault with, on account of their square, solid, inelegant form, and their projecting so far into the buildings wherein they stand. But this has in almost every case arisen from the builder being, in regard to room, so much restricted in the direction of width and height. In churches which have west-end organs this has been more particularly the case, and for no better purpose than that of providing room for a mass of children up each side the instrument. In Continental churches, where the whole width of the west end is frequently devoted to the organ, much larger instruments project to a far less distance into the buildings than do the smaller instruments in English churches.

1200. It may be mentioned, as in some degree illustrating this point, that the performers in an orchestra are placed in a comparatively few long rows, from the correct supposition that such an arrangement has a more beneficial effect than if they were ranged in several shorter rows, behind one another, as though stationed on a wide staircase. For the same reason it will be conducive to the best musical result if the organ be made broad, high, and shallow, rather than narrow and deep.

1201. In one or two instances the analogy between the interior arrangement of an organ and the distribution of an orchestra has been carried to a still greater extent in German organs; for sound-boards have occasionally been made to slope upwards from front to back, like a concert-room platform, upon which the pipes have been ranged in terrace-form, and with the largest Flue stops at the back and the smallest in front. It was in the organ at the Church of St. Maurice, at Halle, built by Schulze, that this last arrangement was for the first time practically brought to bear.

Much room conducive to the orderly arrangement of the organ.

1202. But whatever general arrangements may be considered best to adapt an organ to a particular site, it will be of essential service in a variety of ways to allot as much room to the instrument as can conveniently be spared.

1203. One of the first things which arrests the attention of a visitor, on entering a modern German organ, whether of large or small dimensions, is the appearance of roominess which it presents; and this is speedily perceived to be accompanied by a very simple, yet orderly and systematic, distribution of the several parts of which the organ is composed.

The advantages of large sound-boards.

1204. The roominess is soon discovered to arise, in a great measure, from the ample size of the sound-boards, which, even in instruments of ordinary dimensions, frequently measure 9, 10, and 11 feet in length; and in large instruments, 15, 16, and even 17 feet from end to end. The orderly appearance of the stops also is seen to result from the fact of the sound-boards being sufficiently large to admit of their pipes being placed "over their wind," whereby all *compulsory* recourse to the conveyancing off of pipes is avoided.

1205. This plan—of planting all the pipes on the sound-board—might at first sight appear to involve a great "loss of room," as the phrase goes; but, on account of the admirable manner in which the stops are sometimes planted, this is not the case to nearly the extent that might be imagined. The 8 and 4 feet members of the Flute-work are, in German organs, as in English, frequently of tenor c compass; and the way in which a sound-board is sometimes laid out so as to receive them is as follows :—

1206. The two stops which form the basis of the Manual tone, corresponding to the English Open and Stopped Diapasons, of course extend to CC; and the twelve pipes which form the 8-feet octave of each are ranged in a single row. The room which they require for their accommodation, therefore, is in the direction of width rather than of depth. At tenor c, where the pipes are little more than half-size, the two 8-feet members of the Flute-work commence, and occupy the standing and speaking room now at liberty. For the sake of illustration, these may be supposed to be a tenor c Gamba and a tenor c Hohl-flöte. To give to these two members of the Flute-work the effect of a complete range, when either may be used singly, the Hohl-flöte is grooved into the Stopped Diapason in the 8-feet octave; and the Gamba, which is usually of fuller tone than most English stops of the same name, is grooved into the Open Diapason in the Bass octave. At about middle $d^1\sharp$, where the pipes of the four stops will have become reduced to half dimensions, the single row plantation is discontinued in favour of the double row zig-zag plan, described in a former chapter; and this arrangement is continued up to the top. In a similar way one or two additional 4-feet Flue stops are also frequently worked in from the tenor c groove upwards.

1207. From measurements taken of existing specimens, it was found that the average dimensions of a German sound-board furnished with nine stops, of which the following are the English equivalents—

1. Bourdon	16 feet tone
2. Open Diapason. . .	8 feet
3. Gamba to Tenor c. .	8 feet
4. Stopped Diapason. .	8 feet tone
5. Dulciana to Tenor c .	8 feet
6. Principal	4 feet
7. Twelfth	$2\frac{2}{3}$ feet
8. Fifteenth	2 feet
9. Full Mixture, V ranks . .	2 feet

were 3 feet in breadth, from back to front, and 11 feet in length.

1208. If we may judge from their works, the old English builders attached as much importance to placing the pipes of their organs over their respective grooves as the Germans do in the present day; for we find this system carried out in even their smallest organs; the front pipes and the largest pipes of the Stopped Diapason frequently offering the only exceptions to the rule. They also followed the same plan in their larger instruments, as far as practicable; hence it is no very unusual circumstance to find the original sound-boards by Smith and Harris, Byfield and Bridge, measuring 8, 9, and 10 feet in length.

A Great organ sound-board by the first-mentioned builder, furnished with the following ten stops, viz. :—

1. Open Diapason
2. Stopped Diapason
3. Principal
4. Flute
5. Twelfth
6. Fifteenth
7. Sesquialtera, III ranks
8. Mixture, II ranks
9. Cornet
10. Trumpet

measured 2 feet 10 inches in width, and 9 feet in length.

1209. In the Dome organ from St. Paul's Cathedral, recently removed to Bristol, the late Mr. Hill introduced Great organ sound-boards about 10 feet in entire length ; while, for the Pedal basses, occupying the side wings and back, he provided others which were patterns for spaciousness and efficiency.

1210. In some German Manual sound-boards of the size indicated above, the grooves measured in the bass octave 1 inch in width ; in the tenor and Middle octaves, $\frac{3}{4}$ of an inch ; and in the treble octave and upper half octave, $\frac{1}{2}$ an inch. The pallet-holes were of one length *throughout*, namely, 11 inches ; and the grooves measured $3\frac{1}{2}$ inches in depth. The continuation of the pallet-holes at an unreduced length, in the 4-feet octave, was for the purpose of feeding the extra 8-feet stops that commenced there ; and their further continuation in the treble was to supply the large Mixture ranks, which there returned to an Open Diapason.

1211. It may be added that, although the Mixture included a duplication of the Open Diapason, Principal, Twelfth, and Fifteenth in the treble, there was not the slightest symptom of sympathy, robbing, or unsteadiness in the speech of the pipes, when all the stops were drawn.

"Unoccupied space" in an organ not "lost room."

1212. The difference between the sound-board measurements just quoted is not so great as many might have anticipated it to have been. This, however, is partly due to the bass of the German scales being in some cases somewhat smaller than the English, concerning which more is said further on. But, had it been otherwise, it can never be correctly said that "unoccupied space" in an organ, within reason, is "lost room ;" since, next to the Pipes themselves, which are of course necessary to emit the primary sounds, free air is the most important element in the production of a resonant quality of tone. It is, indeed, true that English organ-builders have frequently been called upon to "get in" a great number of stops into an unreasonably small space ; and one cannot help admiring the manner in which they have frequently grappled with the difficulties which have beset them ; at the same time England is in consequence by no means destitute of organs that are nearly as crowded, and almost as destitute of resonance, as a broker's shop. It is a fact always worth the remembrance of those who would limit an organ-builder too strictly in regard to space, that one of the secrets of the good effect of many old instruments is their *comparative emptiness*. They have not only pipes to produce tone, but breathing room to improve it.

The Abbé Vogler's simplification system.

1213. Some notice should here be taken of Abbé Vogler's "simplification system ;" of which Seidel has given a brief account in his work on organ-building. (See Ewer's English edition, page 26.) "At the end of the eighteenth and the beginning of the nineteenth centuries," says Seidel, "George Joseph Vogler, the famous musician, composer, and organ-player (born 1749, in Wurzburg—died 1814), tried to reform thoroughly the whole former mode of organ-building, an experiment in which he succeeded to a great

degree. His system, aiming at a *simplification of the whole mechanism* of the organ, created great sensation at the time, and found as many admirers as opponents. All that was superfluous, inappropriate, or too costly, he endeavoured to do away with. First of all, he rendered the action simpler by arranging the keys (grooves) in their natural succession; in consequence of which, the construction of the roller-board (key movement) became easier and simpler, and the touch lighter. Vogler's system was adopted in several places, and even now some organ-builders make use of it." Among other Continental builders who construct their organs on Abbé Vogler's system may be mentioned Schulze, of Paulinzelle, near Erfurt, who placed an instrument so made in the Great Exhibition of 1851; which organ was afterwards purchased, and erected in the Exchange Room at Northampton: while, in England, the same plan has for some years past been adopted by Kirtland and Jardine, of Manchester. Some disadvantages, as well as advantages, attend the semitonal arrangement; though, according to the account given to the writer by those builders in Germany and England who have had experience in making sound-boards on this principle, and of whose reports use is here freely made, the former are far outweighed by the latter.

1214. In Vogler's system the grooves are arranged in their natural or semitonal succession throughout the sound-board; that is to say, the CC groove is placed to the extreme left, and the f^3 in alt groove to the extreme right. The pipes of all the stops are arranged in the same order; so that in the Open Diapason, for instance, the CC or 8-feet pipe is placed to the left of the Claviers, and the 4-inch f^3 in alt pipe to the right; the intermediate pipes forming a graduated series. The end of the sound-board to the right is therefore left clear of all but small pipes.

1215. Among the disadvantages attendant on this system of groove arrangement are mentioned the facts of the chief weight of the pipe-work being thrown to one end of the sound-board and building-frame; an increased consumption of wind taking place at that same end of the sound-board; longer conveyances being required to the front pipes to the right, or a special little sound-board for them, or "mute" pipes instead of speaking pipes. The additional weight, and greater consumption of wind at one end, however, have each their ascertained limits, like the greater tension of the bass strings of a pianoforte, and are provided against by a stronger building frame and larger wind-trunks, as the greater tension in a pianoforte is by stronger bracings; while a diminutive sound-board rids the organ of long conveyances.

1216. The advantages attendant on the semitonal system of groove arrangement are stated to be as follows:—The pipes, being chiefly or entirely planted on their own wind, speak more promptly and plumply, and with a firmer tone, than if grooved or conveyanced. But few pipes, if any, being removed from over their grooves, few, if any, conveyances are required; hence a fertile source of loss of wind, hissings of escaping air, impediments to the wind from lodgment of chips, accidental damage of conveyances, and occasional repairs, are removed. The pipes, when planted consecutively, have better speaking room.

1217. *Below* the sound-board, the action being in a direct line from the key to the pallet, no rollers are required; and, there being no rollers, there are fewer centres, and consequently less friction. The *direct-action* thus secures a lighter touch, and more instantaneous response to the finger. The omission of the roller-boards clears the interior of the organ of those walls of mechanism which not only impede the view of the instrument from front to back, but also prevent light penetrating to its remote parts. The tone, moreover, has then more room to *spread*,

and is not thrown back, as must be the case to some extent when two or three roller-boards are in the organ. Roller-boards being dispensed with, the remaining mechanism can be constructed or "set out" more compactly. There is also less liability to stickings in a radiating tracker movement, and less chance of its getting out of order; or, if out of order, it is easier and sooner repaired. The movement, by reason of its greater simplicity, is less effected by changes of temperature; and on account of its whole extent, from the key to the pallet, being under the eye, an organist can at once detect and remedy any trifling disarrangement that might arise. An organ built on Vogler's principle is more convenient to tune than one built in any other manner; and a large organ can be built on the simplification system without the *necessity* for the Pneumatic Lever Action, than on the ordinary system. The larger and more ample sound-board will not increase the cost of the entire work, on account of the omission of the roller-board and numerous conveyances effecting a saving in the expense.

1218. Without waiting to discuss the validity of all the claims that are made in favour of the semitonal arrangement, or whether they are such as are likely to lead to the system in question superseding others, a few words may yet be said concerning certain situations in churches, in the construction of organs for which the semitonal groove arrangement seems to be peculiarly suitable.

1219. The semitonal system of groove arrangement seems to be well adapted for an organ that is to occupy some side or corner position; from either of which points the sound would have to travel in *two* directions. Suppose, for example, an organ so made to be placed on the south side of a church, or in an organ chapel on that same side, with its back towards the south wall; the back of the case would reflect the tone forward, *i.e.*, through and over the front, in the usual way, and therefore *across* the church; while the left side of the case would reflect it to the right, and therefore *down* the church. The small pipes to the right would present no impediment to the sound of the large ones passing over them into the church; while the side of the case to the right, facing the church, by being filled with perforated panelling, or with pipes, would facilitate the egress of the tone in that direction at the same time that it would form an additional adornment to the instrument itself. Or, supposing an organ so constructed to be stationed at the east end of the north aisle, or in a north chapel, with its keys towards the west, the sound would travel through the front, down the aisle, in the usual way, and through the right side, across the chancel and church.

1220. For a divided west-end organ, also, the semitonal groove arrangement appears to be very suitable.

Passage-boards advantageous in more ways than one.

1221. It is very advisable that an organ should be well furnished with wide passage-boards. These will enable one to move about the instrument, either for purposes of tuning or for examination, without unintentionally disturbing any of the pipes, or of injuring the mechanism. Moreover, they are indirectly of beneficial service to the tone of the organ, by being instrumental in securing a free current of air round the various masses of pipes on the sound-boards.

The pipes should be so arranged that the small ones are accessible.

1222. The pipes should be so arranged on the sound-boards that they may all be easy of access for the purpose of cleaning, tuning, and regulating. If large and small pipes be planted together in such a manner that the former present a barrier in the way of the tuner reaching the latter, a frequent and "unnecessary touching or taking out of the pipes" will have to be resorted to, which, as Seidel truly observes, is injurious; as pipes are soon bruised or bent. "Besides," he continues, "if a pipe, after having

been taken out, is not replaced exactly in its former position, it will sound too flat or too high, too strong or too weak."

1223. With regard to the construction of the sound-boards, nearly all that was necessary has been said in a former chapter. The leathering of the table, which is so much dwelt upon in many foreign works on organ-building, is almost universally considered by English organ-builders to be superfluous, if the table, sliders, and upper boards are accurately adjusted to one another.

Double grooves in the bass of large sound-boards advisable.

1224. If there are many stops on a Manual to be supplied, it is better to have two distinct grooves to each key in the bass octave, than one larger groove and one great pallet; and for this reason the large pipes rapidly exhaust the wind from the groove, diminishing the pressure or the density of the air therein; therefore, when drawn, they have the effect of flattening the pitch of the Mixtures, destroying their brightness, and of making the reeds speak slow. By introducing two grooves, the Unison and Double Diapasons and Principal can be placed on one groove, and the Twelfth, Fifteenth, Mixtures, and Reeds, on the other. The rollers would then, of course, be provided with two pallet-arms instead of one only; or, if squares were used, their second arm should be furnished with a small cross-bar, to each end of which a pull-down would be attached. John England, who first introduced double grooves into English organs, used to perforate the sound-board bar that separated the two. Or two pallets, one at each end of the groove, might be employed. It is now a frequent custom to place the 16, 8, and 4 feet flue stops on one sound-board, the smaller flue stops on a second, and the reeds on a third, supplied by a heavy wind. The "trebles" are further placed on separate sound-boards, and blown by a stronger blast.

The roller-boards.

1225. The rollers should be so disposed that the tapped wires, buttons, hooks, &c., that communicate with them can be easily got at for purposes of regulation, renewal, &c., when occasion may require. Wooden rollers and arms are now generally cancelled in favour of those of iron, and some builders also bush the iron studs which support the rollers, *i.e.*, line their perforations with cloth, or make the centre-pins work in leather buttons, to quiet the noise otherwise consequent on their motion.

The bellows.

1226. The bellows should be made of such dimensions that they will easily yield, and continue to give an abundant supply of wind, when all the Manuals are coupled together, with every stop drawn, and the fullest chords are played on the Manuals and Pedal. The first thing Sebastian Bach used to do, when requested to examine a new organ, was to draw out all the stops, and play on the full organ. He used to say, he must first know whether the instrument had good lungs. (Forkel's *Life of Bach.*) A copious supply of wind is more particularly necessary, in the first instance, if the organ is intended to receive subsequent additions. There should be no unsteadiness perceivable in the tone of the organ at the moment when the feeders commence and complete their work; neither ought any clacking to be heard when the valves fall over the suckers in the feeders and the bottom-board; nor should there be any sucking or gasping noise heard when the feeders are being replenished; but which will be the case if the suckers are too few or too small. The feeders and blowing-action should also work with but little noise. Many organs have the Pedal as well as the Manual organs supplied from the same bellows. When this is the case, the tone of the Manual organs should remain perfectly firm and unaffected when any disjunct or staccato passage is being played on the Pedals.

1227. The reservoir of the bellows should of course have inverted ribs, counterbalances, and a waste pallet, which latter will cause the least noise if it be made to discharge the superfluous air into the feeders. The shape of the bellows is a matter of no importance; their proportions must necessarily be influenced in a great measure by local circumstances.

1228. As regards the situation for the bellows, the lower part of the organ near to the ground is the place usually assigned to them in modern English instruments. In German organs they are more frequently put outside the case; as they were indeed in many old English instruments. Where the necessary additional room can be spared, the latter arrangement is the most advantageous, as it allows so much more space for the convenient distribution of the mechanism, as well as admitting of more ready means of access to its several parts for purposes of regulation, repair, &c., besides which the free space then left is beneficial to the resonance of the organ. At Westminster Abbey the bellows are in two chambers under the organ, in the choir screen; at the Temple Church they are in a bellows room below; at St. Martin's-in-the-Fields, and at St. Philip's, Waterloo Place, they are placed in the belfry behind the organ. In many large modern organs the feeders and reservoirs are made quite distinct, and the former placed in some convenient situation outside the organ, where they are blown by one of Joy's hydraulic machines, while the latter are placed close to the sound-boards. This is the arrangement at King's College Chapel, Cambridge. In many large instruments, where there is plenty of room, a special reservoir is placed near to every sound-board, which is an admirable arrangement.

1229. If the bellows are to produce different pressures of wind—to do which they will require to be furnished with upper reservoirs—much additional height will be required for bellows room. Under these circumstances, and if they are to be placed under the sound-boards, the latter must be well elevated; or the bellows might even be kept out of the organ altogether.

The wind-trunks.

1230. The wind-trunks should be large enough to convey an ample supply to the wind-chests; otherwise it will be of little use, the bellows yielding a good quantity. Concussion bellows should also be applied, if found necessary; but if the wind-trunks are capacious, and are not very long, such appliances will probably be less required. If not absolutely necessary, they are almost better omitted than introduced. The writer is acquainted with an instance of a concussion bellows being attached to a new organ, in obedience to one of the conditions of the contract; and of its disturbing the wind, which, before its introduction, was perfectly steady. It is a question whether concussion bellows are not occasionally made too large. When it is seen how small a bellows, in the shape of a tremulant, will disturb the wind, it seems that one four or five times the size can scarcely be necessary to correct the far less accidental disturbance that would be likely to occur in a well-winded organ.

The Swell-box.

1231. The Swell-box should not be less than 2 inches in thickness; and it would be the better for being $2\frac{1}{2}$, particularly if it be a large one. The edges of the shutters should be faced with leather, cloth, or felt, to make them bed closely and shut in the tone. Walker lines the interior of his swell-boxes with very stout brown paper, about $\frac{1}{8}$ of an inch thick, to further subdue the tone when the shutters are closed.

The scale for the pipe-work.

1232. The general dimensions of an organ containing a given list of stops are influenced by no one thing more than by the scale adopted for the bass pipes. Or, to put the fact in another

shape, no single circumstance affects the question as to the number of stops which may be satisfactorily placed in a given space, more than the wide or narrow measure selected for the large pipes. Continental organs of moderate dimensions ordinarily contain from 4 to 6 Pedal stops; while those of the first class frequently have from 15 to 18. (See all the Foreign Specifications, in the Appendix.) To any one who might be led to calculate the standing-room of such instruments by the amount of space necessary to accommodate a single English stop of the scale to which many sets of "Pedal pipes" have been made, it would seem that such organs must occupy a site almost sufficient for a small church. Such, however, is not the case. It was stated in the first chapter of this division that in Germany most of the Pedal stops are properly viewed as simply "Basses" to some of the Manual stops. This being the case, their scales exhibit but a very slight advance on those of the Manuals; one pipe only frequently being the extent of the difference. The 16-feet Open basses of Continental organs, moreover, are frequently made of wood, as in English. Of the three fine instruments by Silbermann at Strasbourg two contain "Principal Basses" of this material (see Foreign Specifications); and of these organs the latter has two open wood Pedal stops of 16 feet; yet the largest of these only measures 9 inches by 11. In some very large German organs, having about 16 stops on the Pedal, and including two 16-feet open wood stops, independently of the Violone, the scale of one is sometimes advanced, and the stop hence called "Major-Bass," *i.e.*, *Great*-Bass; but even the CCC pipe of this stop seldom exceeds 10 inches in width by 12 in depth. In two instances only could the writer trace the existence of stops of greater calibre in foreign organs. The "Contra Violone" at Cologne Cathedral (Foreign Specifications) measures 12 inches across the mouth, and a stop approaching the scale of English Pedal pipes occurs in the St. Eustace organ at Paris. (Foreign Specifications.)

1233. In English organs, even of ordinary size, the CCC Pedal pipe not unfrequently measures 18 inches in width and 20 inches in depth: some examples are as much as 2 feet in depth.

1234. Then, of the Continental scales of longer wooden pipes; in the organ at St. Paul's, Frankfort (Foreign Specifications), built by the famous Walker, of Ludwigsburg, which has two Pedal stops of 32 feet, one measures 11 inches across the mouth, the other $15\frac{3}{4}$ inches. The CCCC wood pipe in the Cathedral organ at Bremen (Foreign Specifications), and in St. Mary's Church, Wismar (Foreign Specifications), both by Schulze, measure exactly 12 inches each across the mouth. Comparing these dimensions with the English scale given above, it is seen that the 16-feet Pedal pipe, as it exists in many of our ordinary-sized organs, exceeds in bulk the 32-feet pipe of cathedral and other first-class instruments of the Continent.

1235. The vast disparity of breadth in proportion to length between English and foreign organ pipes naturally suggests these three questions—(1) How have pipes of such huge bulk come into use? (2) What may be their effect? and (3) Is that effect such as will justify the allotment of so much space, not easily spared, to their accommodation?

1236. The first open wood Pedal pipes made in England were those added by Avery to the organ in Westminster Abbey. They were "Unisons;" and, from that circumstance, being designed simply to reinforce the Manual Diapasons in the bass, no doubt proved sufficient for that purpose. What may have been the scale of those pipes the writer has not been able to ascertain; but, subsequently, the measure for the GG unison Pedal pipe became, and for several years continued to be, ordinarily, 12 inches for the depth; that is to say, the $10\frac{2}{3}$

feet pipe was equal in bulk to the 16-feet major bass pipe of Continental organs. When Pedal pipes came to be altered in pitch from Unisons to Doubles, a single set, of the scale and power before in use, was incapable of asserting its independence.

1237. As, in former days, the compass of the Manuals was extended downwards, as a primitive method of obtaining from it deeper tones, so the calibre of the "Pedal pipes" was now augmented, gradually, from little to more, in the hope of obtaining from them the effect of a proper Pedal bass, until they at length assumed the dimensions already quoted. The huge scale, therefore, originated from a correct feeling, namely, a consciousness of the necessity for a Pedal bass, proportioned in power to the Manual departments of the organ, but accompanied at the same time by a misconception as to the proper method of carrying that feeling into effect. A "Bass" to the entire organ was attempted to be forced from a single rank of pipes, and with astonishing success, had one only, and that of an unvarying kind, been required from the Pedal. The effect of such a Pedal stop was certainly most powerful and commanding, but not *amalgamating*. It formed no suitable bass to any one stop in the organ. As a Pedal continuation to the Manual Diapason, it was without the true, serious, calm, deliberate, and mixing characteristics of that stop. It was also too powerful and predominating for the numerous softer effects in constant requisition in all organs, and only appeared to be in proportion when used in conjunction with the loud organ; but the employment of the full organ being the exception, rather than the rule, the heavy sound of the great stop constituted, in the great majority of cases, a very unsuitable bass. Then, with regard to standing room, the large scale Pedal pipes in some cases occupied as much room as would have accommodated *three* 16-feet Pedal stops made to a more strictly correct measure; and it must be obvious that a Pedal organ possessing an Open Diapason, Stopped Diapason, and Trombone, would have formed a far more efficient and *tractable* bass to an instrument.

1238. Experiments subsequently made, together with a closer acquaintance with the Continental principles of the art, conduced to make evident the nature and extent of the original misconception to which reference has already been made; and to bring into clear view the true means by which it was to be rectified and superseded. These included a reduction of the measure previously adopted for Pedal *pipes*, and an increase in the number of independent Pedal *stops*. Among the first to revise their Pedal bass scales were the late Mr. Hill and Mr. T. Robson. Mr. Hill, who had built a greater number of large organs than any other man in England, and had therefore given the large Pedal pipe scale the most extended trial, thought it not inconsistent with the high position and character as a true artist to scrutinise his former work, and to materially modify the previously received proportions for large wood pipes. Added to this, he insisted on the importance of securing several stops instead of one; an honourable course, which he ceased not to follow stedfastly and consistently up to the time of his death.

1239. Reverting to the scales of Continental stops before given, some of them will be viewed as being extremely small. The quantity of tone, however, produced from the largest of them is really most astonishing. Being copiously winded, they speak with a promptness and fulness that is highly satisfactory. A very careful trial and comparison of the smaller-scaled open wood stops of Continental organs with the huge scale Pedal pipes of English instruments, however, leads to the firm impression that the most useful scale for musical purposes lies between the two. And that such a scale is equal to the production

of the best effects is exemplified in the excellent 32-feet open pipes of the Westminster Abbey organ, made by Mr. Hill, the sound of which is sufficient to fill the Minster, yet does not overpower even a single voice, which is detected the moment it is added to that of the other stops by the richness which it imparts, yet does not obtrude itself, but on the contrary, blends in the happiest manner with the sound of the rest of the organ. The scale of the 16-feet pipe of this stop is 10 inches by 11½ inches, which is a slight advance on Silbermann's Strasbourg scale, already quoted, and of the 32-feet pipe, 19 inches by 22 inches, which is a little in advance of the Frankfort scale. For a unison Pedal Open, the German major bass scale already given, namely 10 inches by 12 inches for the 16-feet pipe, was adopted by Robson in his organ in Trinity Church, Sloane Street, where, for a moderate-sized organ, it answered as well as could possibly be desired. At Westminster Abbey, where the Great organ is extended down to CCC, to serve as a substitute for an independent Pedal, the 16-feet pipe of the Pedal Open Diapason measures 13½ inches by 16 inches. This, although far below the old Pedal pipe measure, yet forms an admirable and ample "Major Bass" scale to the rest of the organ.

1240. Then, with regard to large metal pipes, great variation has likewise, at different periods, been made in their scale, also, in English instruments. The organ in St. Paul's Cathedral had two Open Diapasons, part of the original work of Father Smith, on the Great Manual. The article in the *Musical Gazette*, so often quoted, says of them, "They have always been esteemed the finest Schmidt ever made, and are regular and uniform in the quality of tone throughout." The largest of the two 8-feet or CC pipes of those stops measures somewhat less than 6 inches in diameter. The original FFF pipe at the Temple was 7 inches in diameter, and the largest of the two original CCC or 16-feet pipes at St. Paul's is a little under 10 inches across. Towards the latter end of the last century Green effected a considerable increase on the measurement above given. This was before the introduction of Pedal pipes (which either originated with Avery or about his time), and no doubt was intended by Green to impart additional weight to the bass of his organs. The CC pipe he increased in diameter from 6 inches to 8 inches, his GG to 11 inches, and his FFF from 7 inches to 12 inches; that is, to 2 inches beyond Smith's scale for the 16-feet pipe. Avery and England, who succeeded Green, availing themselves of the advantage which a set of small Pedal pipes presented, reduced the scale again for the bass of the metal Diapasons.

1241. In specifications for modern organs, even those for small churches, it is sometimes stipulated that the CC metal pipe shall measure 8 inches in diameter, or, in other words, shall be wider than Smith's large cathedral scale for the FFF pipe. As a matter that materially affects the question of room, it is worthy of consideration whether the advantages of so greatly an enlarged scale are commensurate with the increased quantity of space required to accommodate pipes of such a measure. Metal pipes of so great a scale no doubt produce a somewhat heavier, thick, and more ponderous tone than others of less bulk, but not so close, firm, and *clean* a sound. There is always sufficient difficulty in obtaining an even tone from a stop that increases in scale gradually from the lowest pipe up to the top one. It was, in fact, this difficulty which led Muller of Amsterdam and Batz of Utrecht to apply duplicate pipes to the trebles of their organs, and Cavaillé-Coll to adopt a heavier wind in the upper part of the Manual compass to overcome it. But if the scale be enlarged from the tenor *downwards* also, and a more powerful tone *really* be produced in that direction, it seems clear that the tendency to an inequality in the general effect must be increased. It is well

known that, for richness, fulness, and power, the bass of Smith's Diapasons have never been surpassed. If they ever failed, as they occasionally did, it was in the upper part. Moreover, it is by no means a matter of course that an enlargement of scale will result in the production of a tone of an improved quality, as the following extract will show. The *Christian Remembrancer* for October, 1833, page 624, speaking of the Temple organ, says, "It is somewhat remarkable that Schmidt should be able to produce so ponderous a tone in the lower notes of the Open Diapason out of so small a scale pipe, the FFF measuring only 7 inches in diameter, whereas the same pipes in Green's organ at Greenwich Hospital measures 12 inches, and does not give so fine a note. The fact is, when the scale is increased the pipes then no longer remain members of the "Principal-work," but, from that enlargement, merge into the "Flute-work," and at the same time also cease to retain that clear and pure character of tone which is so closely associated with the idea of a true Diapason, and which then is exchanged for a heavier and less silvery tone. This refers to the large pipes. As the "Diapason-measure" is exceeded higher up in the musical scale, the cornet-scale is approached. For instance, if a Pedal Principal were to be made to a much-increased measure, so that its middle C^1 pipe (2 feet) were to be advanced from about 2 inches to nearly $2\frac{1}{2}$ inches in diameter, it would produce a tone, powerful and broad indeed, but utterly unlike that of a member of the Diapason-work.

1242. It has already been mentioned that the largest of the two 16-feet pipes at St. Paul's Cathedral does not measure quite 10 inches in diameter, neither do those made by Cavaillé-Coll, in his magnificent new organs at the Madeleine and St. Vincent de Paul, at Paris. And of upwards of twenty examples in German organs which the writer measured, not one exceeded 10 inches across, while the smallest was $9\frac{1}{2}$ inches only. The corresponding pipe in modern English work has occasionally been made as much as 14 inches across, that is, within an inch of the 32-feet pipe at Haarlem, which measures but 15 inches over. There seems, however, to be no essential advantage arising from the use of such very large scales, while the waste of room which they involve is very great.

1243. The subject of the scale of large Open wood and metal pipes has been entered into thus fully, because those who have to decide on the comparative merits of different specifications are sometimes apt to attach undue value to those which promise "good bumping scales," and think lightly of others which do not—to consider the necessity for great scaled pipes as an unquestionable fact, and their advantages as being beyond doubt.

1244. Stopped wood pipes present a no less variation in regard to scale than do those of the Open kind. The ordinary English measure for the CCC Bourdon or Double Stopped Diapason pipe, 16-feet tone, is $7\frac{1}{4}$ inches in width, by 9 inches in depth. Occasionally this scale has been increased to 12 inches in depth, but it has seldom been much lessened in England. The Swiss scale for Stopped pipes is somewhat larger than the first of the above-mentioned English measures; *i.e.*, it is about $9\frac{1}{2}$ inches by 11 inches for the CCC pipe. In some modern German organs the scale of the large Stopped pipes has been much reduced, and that without involving any loss of tone, so that a great saving of room has been effected. The unreduced quantity of tone from the narrower pipe is secured by allowing a more copious supply of wind to enter the foot, instead of shutting part of it off by plugging, making a wider wind-way, and by cutting the mouth high. In this way a perfectly firm, plump, and pure tone is obtained from a CCC pipe, measuring $6\frac{1}{8}$ inches by $4\frac{3}{8}$. A Bourdon

of the above scale occurs on the Great Manual of the German organ in the Exchange Room at Northampton, and produces a remarkably full tone. The smaller scaled pipes present the additional advantage of being more easily planted over their own wind on the sound-board. It should be mentioned that the pipes of a stop, made to the German scale just referred to, sometimes decrease in size or bulk more gradually than is common with English scales; that is to say, the scale is not reduced to half measure until it has reached the pipe that sounds the interval of an *eleventh* from the pipe whence the calculation commences. The following therefore presents an outline of the scale in question :—

GREAT MANUAL BOURDON SCALE.

Pipe.	Depth.	Width.	Diameter of foot-hole.
CCC.	$6\frac{1}{8}$ inches . .	$4\frac{5}{8}$ inches . .	$1\frac{5}{8}$ inch.
GG	$4\frac{3}{4}$ inches . .	$3\frac{1}{4}$ inches . .	$1\frac{1}{2}$ inch.
CC	$3\frac{5}{8}$ inches . .	$2\frac{13}{16}$ inches . .	$1\frac{3}{16}$ inch.
FF	$3\frac{1}{16}$ inches . .	$2\frac{5}{16}$ inches . .	$1\frac{1}{8}$ inch.
Tenor c. . . .	$2\frac{3}{16}$ inches . .	$2\frac{11}{16}$ inches . .	$\frac{15}{16}$ inch.
Middle b flat. .	$1\frac{1}{2}$ inch . .	$1\frac{2}{16}$ inch . .	$\frac{7}{8}$ inch.

1245. The height of mouth for a 3-inch wind is, on the average, about equal to half the width.

1246. Another class of covered stops, producing a delicate tone, and called, in Germany, Lieblich Gedackt (Lovely-toned Stopped Diapason), is made to a smaller scale again than the Bourdon. It occurs in many foreign instruments; and is also frequently introduced by Schulze to form the Unison and Double Stopped Diapasons of his Choir or Swell organs. Its scale decreases in the same ratio as that of the Bourdon already noticed.

LIEBLICH GEDACKT SCALE, FOR CHOIR OR SWELL COVERED STOPS.

Pipe.	Depth.	Width.	Diameter of foot-hole.
CCC . . .	5 inches . .	$3\frac{3}{8}$ inches . .	$\frac{15}{16}$ of an inch.
GG. . . .	$3\frac{3}{4}$ inches . .	$2\frac{11}{16}$ inches . .	$\frac{13}{16}$ of an inch.
CC	3 inches . .	$2\frac{3}{16}$ inches . .	$\frac{3}{4}$ of an inch.
FF	$2\frac{1}{2}$ inches . .	$1\frac{11}{16}$ inch . .	$\frac{11}{16}$ of an inch.
Tenor c . .	$1\frac{7}{8}$ inch . .	$1\frac{3}{8}$ inch . .	$\frac{9}{16}$ of an inch.
Middle b flat	$1\frac{1}{4}$ inch . .	$\frac{13}{16}$ of an inch. .	$\frac{3}{8}$ of an inch.

1247. The peculiar value of the Lieblich Gedackt scale for the Swell-covered stops consists more particularly in the comparatively small amount of standing and speaking room required for the accommodation of pipes made to that measure. The CCC pipe is scarcely any wider or deeper than the CC pipe of some English scales, that is to say, the lowest pipe of a Double Stopped Diapason made to the Lieblich Gedackt scale does not call for more standing room than the lowest pipe of some Unison Stopped Diapasons made to the English scale. It consequently admits of the entire stop being placed inside the Swell-box, whereby its whole range derives the advantage and benefit of the crescendo and diminuendo; whereas, on account of the size of the bass pipes of a Bourdon made to the usual English scale, the lowest octave of the stop has generally to be placed outside the box, even in the largest Swells. Examples of Lieblich Gedackts, as Choir organ stops, of 16 and 8 feet tone, occur on the upper Manual of the organ at the Exchange, Northampton; and of 16, 8, and 4 feet tone at the Temple.

1248. It will now be seen why a German organ should not cover the great space that might at first have been imagined. The lowest Open Stopped and Pedal pipes of an ordinary GG organ frequently equal in bulk the 16-feet pipes of a German organ.

1249. There is one thing in connection with the question of large and small scales that is well worth mentioning in this place. It does not answer to plant large scale Bourdons semitonally. This fact was proved by an organ-builder in the following manner. The CCC pipe was voiced, put in its place, and tuned; then the CCC♯ was completed in a similar manner, when it was found that the CCC pipe had become uncertain and windy in its speech. The DDD was next added, and, having in its turn been tuned and voiced, the CCC♯ was tried, and that was found to be spoiled by the DDD, as the CCC had been by the CCC♯. Four more pipes, up to FFF♯, were added, one by one, and every successive pipe destroyed the speech of the one below it. There was not a single exception; the only good sound was from the FFF♯ pipe which completed the series. It was shown by this experiment, (1) that the speech of a Stopped pipe is not affected by the note its *semitone below*, but by the *semitone above*; and (2) that the vibration at the mouth of a large scale Stopped pipe has an influence upon the pipe its semitone below, that does not appear in *small* scale Stopped pipes; and it is argued from this that the semitonal arrangement *and* the large scale English Stopped-work could not be satisfactorily combined. If this be true, it is curious that, in the system of semitonal arrangement, the scale should be required to be small, and for two very opposite reasons (at least, having no intermediate relation); 1st, that they may be planted without loss of room; and 2nd, that an acoustical phenomenon or law requires them to be so, *if* planted semitonally; and, of course, it would be absurd to set out a sound-board semitonally to simplify the action, and then by conveyances, groove-boards, or such like means, to plant the pipes otherwise.

The materials for the pipe-work.

1250. The different metals, woods, and compounds used in the construction of organ pipes were enumerated in a previous chapter. In the specification for which the organ-builder's estimate is afterwards to be obtained, it ought to be distinctly specified what materials are desired to be used in the formation of the pipe-work; which stops, if any, are to be made of pure tin, which of metal, and which of wood; also, if some are designed to be made partly of tin or metal, and the remainder of wood, on what note the metal pipes are to be discontinued and the wood ones to commence; and lastly, the proportions of tin and lead to be employed in the composition of the metal. One of the particulars on which the ultimate cost of an organ rightly depends is the standard of the metal that is to be used, and the gross weight of it to be embodied in the instrument; and an organ-builder who proposes to employ tin or the best metal, in good quantity, must necessarily require a higher sum for his work than he would demand, were a less valuable metal and a smaller quantity of it understood to be all that was desired. An estimate, therefore, that would appear to be a high one, were not these circumstances to be taken into consideration, will often prove to be both just and reasonable when it is more closely examined. But English organ-builders are by no means agreed on certain questions relating to metal pipes; some considering that "substance" in material is of more importance than quality, while others view quality as of more consequence than substance. Preparatory to offering any observations on these points, it may be observed

that the bodies of metal pipes should *vibrate*, but not *tremble;* that is to say, they should vibrate from the natural elasticity of the metal or compound of which they are made, but not tremble from thinness of material or weakness of texture. Of the two materials which form the chief ingredients in organ pipe metal tin is light, firm, and elastic; and lead, heavy, weak, and comparatively inelastic.

1251. Strictly speaking, it is the periodical motion of the column of air that is within a pipe, rather than the pipe which encloses it, that is the source of the tone. The substance and quality of the walls of the pipes, however, have a great deal to do with the strength and character of the sound produced; and in this way, if the material of which a pipe is made be thin in substance, it will be weaker, more pliant, and consequently less impatient to return to its state of repose. The pipe therefore will not bear much blowing, as, in that case, its sides would not be strong enough to resist or counterbalance the power of the wind; and would tremble, and produce a blurring sound. Being thus unable to resist any *violent* excitation of the column of air within, a thin pipe can only be *slightly* blown, and hence will produce only a light tone. If thin material, however, be pure tin, or good spotted metal, it will on that account be firmer; and the sharp and rapid vibration of a pipe made from such sheets will cause the tone to be of a more refined and silvery quality. The pipes of a Gamba are the better for being thin and of fine metal.

1252. A pipe made of thick metal will bear much more blowing, without its vibratory motion being exaggerated into a trembling; consequently it will be capable of producing a much fuller tone than a thin pipe of the same scale. For instance, the stronger the organ-wind, or the greater the quantity of it entering a pipe through a larger foot-hole, the more powerfully will the column of air within the pipe be excited, and consequently the greater will be its friction against the sides of the pipe. If the strength and firmness of the pipe have been correspondingly increased, it will successfully resist the influence of the stronger current; the whole resulting in the production of a clearer and better tone. If, added to its substance, the metal of the pipe be compounded chiefly of tin, this will cause it to be firmer still, and therefore more *resisting* at first; but if fully excited by the more copious blowing which it will bear, it will prove more elastic, and more impatient to return to its state of rest; and, from the great strength and power of its vibrations, will produce a sound remarkable for clearness as well as for a ringing character. A heavy pipe is therefore good for a Diapason.

1253. It has been customary to attribute the distinction in the tone of the organs of different builders to the voicing and winding of the pipes, which is of course true to a great extent; but the substance and quality of the metal are by no means unimportant agents in the matter. Father Smith used metal of fine quality and of great substance, usually, for his front pipes. His inside pipes were of a metal of less high standard, but were very thick and heavy. Green employed good spotted metal, but of less thickness; and Smith could no more have obtained Green's light, playful, and musical tone from his thick pipes, than could Green have produced Smith's powerful and ringing tone from his thin pipes. Green was aware of this, particularly in regard to bass pipes: hence his great enlargement of the scale; though, from the thinness of their material, they would not bear so much blowing.

1254. But, whatever difference of opinion may exist as to whether and to what extent the tone is influenced by the metal or compound used, there can be no doubt of the greater *durability* of pipes formed of tin, or chiefly so,

over every other composition that has been commonly employed for the purpose. The metal used by Harris and Smith, for the chief part of the pipe-work of their organs, contained a great proportion of tin among its ingredients; and the present condition of the original pipes of many of the instruments constructed by those makers fully confirms the correctness of the opinion as to the lasting character of organ pipes made, in the first instance, of metal of good quality and thick in substance. Harris's organ, at St. Sepulchre's, was built in 1667; Smith's, at the Temple, in 1685; and that at St. Paul's Cathedral, by the last-mentioned builder (the front pipes of which still remain), in 1695. The comparative durability of metal compounds, of various kinds, was well illustrated in an organ which passed not long since into the hands of an organ-builder. The organ had been made rather more than a century; and while the original pipes, of spotted metal, were found to be quite sound, the feet of others of *subsequent* introduction, formed of inferior metal, had been so attacked by the strong acid in the wood of which the upper-boards were made, that the apex of the feet of several of them was completely eaten away.

1255. Other evidences of the great durability of substantial pipes of tin, or good metal, are afforded by the great age of several Continental organs, the dates of the erection of which are authenticated. The organ in the Cathedral at Constance, in Switzerland, was built in 1518; that in the Cathedral of Freiburg, in Bresgau, in 1520; that in the Cathedral at Antwerp, in 1645; and that in the Cathedral at Lucerne, in Switzerland, in the year 1651. The last has recently been replaced by a new organ. The particulars of numerous other old organs are contained in the Appendix; but, from the *approximate* age only having been ascertained, they cannot be quoted here.

1256. Moreover, the writer put the question distinctly to a German organ-builder, how long he considered an organ ought to last; and he gave it as his deliberate opinion that, if well constructed, out of the best and most substantial materials, and taken the best care of, it ought to continue good for 400 years. An organ lasting for so protracted a period will no doubt appear strange to many; but the undoubted age of numerous Continental instruments, together with the good state of preservation the pipes of many of them are in, fully justify the above calculation; while the fact of certain of the stops of old organs being in some cases retained in their successors, as at Cologne and Liège, further supports it.

1257. That pipe-work made of metal of good quality and substance retains its fulness, brilliance, and "ring," for a very lengthened period, is a fact fully borne out by the effect of numerous old English organs. Age also may have exercised some influence in imparting to the tone that peculiar richness, purity, and healthy clearness for which many old instruments are so remarkable; although, as there are good, bad, and indifferent old instruments, and in some cases by the same maker, it cannot always have had so much to do with the production of the peculiar mellowness that some imagine.

1258. And if time really effects so much for an organ, how important must it be to secure the use of the most durable metal for its pipe-work; otherwise, when the mellowing hand of time ought to be bringing the instrument to perfection, the pipe-work will have seen its best days, and be becoming useless when it ought to be enhancing in value. Zinc is now much used for large metal beyond 4 feet speaking length, and, when properly prepared, is very efficacious. It is particularly useful for organs that are to be exported, as the pipes do not flatten during the journey.

1259. While, in some instances, the scale has been increased for the large

metal pipes, it has been decreased for the small ones forming the "chorus." When the scale of the harmonic series of stops is "kept up," and the pipes are well blown, a tone is produced that is remarkable for fulness, breadth, and power. When, on the contrary, their measure is reduced more rapidly, the small stops are less full and more penetrating in tone, and require the frequent, or even constant, addition of a reed stop to modify their keenness and impart strength to the sound. In some German organs, both codes of scales are adopted; that is to say, a rather large scale is followed for the harmonic series of stops, including the *first* Mixture, and a smaller for the second Compound stop; the 2-feet pipe (c^1) of the latter being usually of the same diameter as the e^1 or f^1 pipe of the Diapason, *i.e.*, of Geigen Principal scale. The second stop is then sometimes called "Scharf," or "Cymbal," either of which names would suggest the idea of a ringing, sharp-toned stop. The third Compound stop is usually a Cornet, so that on many German Great Manuals will be found, first, a Mixture of nearly full Principal scale, a second rather below, and a third one above that measure.

1260. Wood pipe-work is introduced to a greater proportionate extent in modern than it was in old organs, as it effects a judicious saving in the expense. Many of the largest pipes in the Pedal organ are almost invariably made of this material; so also is some of the Flute-work of recent invention or introduction into this country. The Stopped Diapason and Flute stops of modern organs, too, are frequently made of wood; so are the bass pipes of the Open Diapason; while, in old instruments, the treble of the former and the bass of the latter were more commonly made of metal. When long wood pipes are made to a small scale, they are capable of producing a very close imitation of the "metal tone," and in that case form a most efficient substitute for good metal pipes, in the bass, when the latter are not attainable. In some foreign organs a wood bass of this kind is united to a metal treble so successfully, that it is scarcely possible to trace on what note the one material is discontinued and the other commenced.

The price of the organ.

1261. We have now arrived at the last, but by no means the least important question for consideration, namely, the *price* of the organ, This matter necessarily rests, to some extent, with the builder chosen, but remains to a much greater degree in the hands of the purchasers.

1262. From what has been explained in the preceding sections it must be obvious that there is a durable, complete, but *costly* way of building an organ, and an unsubstantial, incomplete, and *cheap* way of making it. It is also equally evident that organ-building may be viewed as a calling of high art, or treated merely as a matter of business; and it will be exercised in either the former or the latter spirit, according to circumstances.

1263. Under the most extreme circumstances, the organ-builder must *exist* by the exercise of his calling; but at the same time it is only consistent with the proper feeling of ambition that actuates every genuine artist, that he would prefer *also* rearing specimens of his art to which he might point with pride, as well as his successors for generations after him. But this second condition must obviously depend on the means placed at his disposal.

1264. On being applied to to make proposals for the construction and erection of an organ, an organ-builder may draw up a specification for an instrument of given contents, and, intending to use certain materials, and to devote much attention to various matters of detail and finish which cannot be specified in an estimate without extending to the length of a pamphlet, place his charge at, say, £1000. He may, however, have good reason to know that that figure

will ensure him the *loss* of the "order;" accordingly, without altering one of the *written* conditions of his contract, or foregoing one penny of his own fair profit, but simply by reducing the standard or substance, or both, of his metal, and paying less regard to the minute excellencies of his work, he can, "to meet circumstances," at once lower his estimate from £1,000 to £850. It is in this sense that "the price of the organ" is said to remain so much in the hands of the *purchasers*. But when the organ is completed, will it rank as highly, *as a work of art*, as it was originally intended by its designer it should do? Will it reflect more than *temporary* credit on its builder? A few years pass, and *the organ itself* probably solves these problems. And, as though to reduce its existence to the shortest span, the crowded organ has perhaps been consigned to a site bounded by cold or damp walls, where the leather-work has quickly rotted, the brass-work corroded, the iron-work rusted, the glue soddened, and the accurate adjustment of the several parts of the wood-work, by swelling, been disturbed. Crooked or bruised metal pipes, cracked wooden pipes, running sound-boards, twisted rollers, double frictional resistance opposed to the fingers at the keys, and numerous other such fatalities, too frequently indicate what are and must ever be among the most probable distinctivenesses of the "cheap organ." Nor is the builder exactly to be held responsible for all this, if he gave timely advice and warning.

1265. So far it has been shown by how easy a course the price of an organ of a given size may be materially reduced, to accommodate the estimate to particular circumstances. But the process may be reversed; *i.e.*, the size of an organ may undergo great *apparent* increase, when "a grand organ" is desired for the price of one of ordinary dimensions.

1266. An organ with, say, fifty stops will cost either about £1,000 or nearly £2,000, according to circumstances. If its specification be drawn up in a spirit consistent with the magnitude of the work, as *implied* by the number of its stops—if the stops chosen are introduced mostly in a "complete" form, and if a just proportion be observed in the distribution of the stops between the Manuals and Pedal—the cost of such an instrument will certainly approach the higher of the two rough estimates above given. But then it will also be a genuine specimen of high art organ-building, carried out in its amplitude and integrity. Among the fundamental laws of that system are these: if a great Manual be furnished with sixteen stops, these should include at least two double stops, one of which must be a Double Open Diapason throughout. Or, to follow the German form of expression more closely, the Great organ should be a "16-feet Manual." Then all the Manuals—by which is meant the *organs* as well as the *keys*—should be of equal, that is CC range; and the Pedal moreover should, as a *minimum* proportion, have at least one-third as many stops as the Great Manual.

1267. These and other governing rules of the science, however, can only be recognised, or, at least, followed, when "the price" will admit of their being so. But it too frequently happens that the approximate price for the organ has already been fixed, and the hoped-for number of stops also considered; in which case, all that is left for an organ-builder to do, who desires to secure the order, is to prepare a design that will as little as possible run counter to these performed expectations. He sees clearly that a plan for an instrument on the most artistic principle will exclude itself by its appended estimate; that there is every probability of the prize falling into the hands of one who can prepare the most "promising" specification; therefore ideas about "art" must subserve to those relating to "business."

1268. Nor can organ-builders fairly be held accountable for adopting the obvious alternative thus imposed upon them, and which amounts to this in effect, if not in words: he who will prepare the specification that seems to promise the most extensive instrument for the stated terms—who, in fact, can the most successfully make what would form a smaller organ look like a larger upon paper—will stand the best chance of securing "the order." And the ingenuity sometimes displayed in estimates drawn up to meet such expectations almost calls for admiration. First, instead of the specification stating that the proposed instrument shall be built on the German *system*, which would be embodying a great deal, all it will promise, if it be prudently drawn up, is that it shall be made to the German *compass*, which is, at the same time, the old English compass of two centuries ago, and implies but little. Next, several of the stops are planned to draw in *halves*, every such divided stop thus appearing as *two*; or they are introduced in an incomplete form to meet other incomplete stops.* In this manner a great step is made towards securing the necessary array of "stops," many persons judging of the excellence of an organ by the number of its *handles* rather than by the excellence and completeness of what those handles *govern*. The *couplers* even, to swell the number, are sometimes enumerated as "stops." Then the important distinction between "standard size" and "size of tone" is overlooked, and the two portions of the Stopped Diapason, which together form in reality but one stop of 8-feet *tone*, in consequence bear the aspect of two stops of 8 *feet*. The Bourdon, also, if divided, appears as two stops of 16 *feet*. In this manner the stops in question, and by consequence the department to which they belong, are left open to a flattering estimate of their real dimensions.† The *one* Sesquialtera of V ranks, again, which is to be found in all the most important organs of Germany, as well as those of Bridge, Byfield, Harris, and Snetzler, has to be made to draw as two or even three stops. Then the Swell *organ*, which is essentially of English invention and development, and is more highly and justly appreciated in this country than in any other in Europe, is a department in the construction of which an organ-builder takes peculiar pride and interest; this must be cut short at tenor c, which denudation deprives the Swell of its finest octave, though at the same time it affects a saving of nearly £100 in the cost of that department alone, in the instance of a design for a large Swell, and must therefore be resorted to as one means of keeping down the price of the instrument. The Swell *Manual*, indeed, perhaps runs "throughout," though that is of little value without its proper pipes. Numerous small, inexpensive, and incomplete stops, again, find admission, particularly in the Choir organ, which assist in making up the required number at no great outlay; while many large and costly ones are excluded, to bring the instrument within the narrow bounds prescribed by the

* As a matter of fact, it may be mentioned that two of the modern organs that are the most free from half and incomplete stops are those in the church of St. Mary at Hill, and St. Walburgh's Catholic Church, Preston, both by the late Mr. Hill. The former has but four such stops among a series of thirty; the second, not one stop of broken range among thirty stops. Many other builders are now equally averse to the half-stop system.

† It has already been explained that it is not the *tone* of the deepest *sounding* covered stop, but the "standard length" of the largest stop of the Open Diapason species, that fixes the size of a Manual or Pedal organ. Among other instruments, of which the Great organ department is a 16-feet Manual in the strict sense of the term, must be classed those at St. Paul's, by Willis; and at Buxton Road and Highfield Chapels, Huddersfield, by Robson and Walker.

stipulated terms. In this manner the admirable rule which lies at the very foundation of the German and French *systems* of organ-building—that the Pedal shall have, at the least, one-third as many stops as the Great Manual—and which is specially intended to check all excess in small or incomplete stops, as well as the slighting of large and more important ones, is treated as though it had no existence. By the above and other such means, a specification for an organ of almost any number of stops—*i.e.*, handles—may be provided, to suit almost any sum that may be named. But it cannot be supposed that any organ-builder who has a real love for his art can *prefer* building an instrument according to so unhealthy a system, however readily he may *consent* to do so. Yet, despite the discouraging influences under which it has been sometimes carried on, organ-building has nevertheless progressed marvellously within the last fifteen years, particularly in respect to those mechanical details which ensure quietness in the action generally, and which relate to lightness and promptness in the touch of large instruments, as well as in the selection and variety of the stops; and in regard to the completeness of the compass of the stops, and the excellence of the metal used in their conformation, great "progress" has also been made, particularly by some of the younger firms, by *going back* to the customs of a century or more since. These latter returns, it is but reasonable to hope, are accompanied by a corresponding return to something akin to the fair and liberal terms paid to the artists of former times. What these might have been may be gathered from the following extracts, taken quite at random, from a list of many which were ready to hand. It is recorded that Father Smith had 1,000 guineas for the organ (about 20 stops) at the Temple Church, and 500 more for the case; for the St. Paul's Cathedral organ (about 28 stops), £2,000; and for that in Durham Cathedral (17 stops), £700 and the old organ. For the Westminster Abbey organ (21 stops), Schrider had £1,000; and Green, for the organ at Greenwich Hospital (26 stops), £1,000, exclusive of the case. Harris had for the St. Patrick's Cathedral organ, Dublin (13 stops), £505. Then, for a single stop, Byfield received £50 for the Trumpet in the cathedral organ at Chichester. It is, indeed, true that most of the stops in the organs above mentioned were "whole" stops, and not only so, but were even beyond the full necessary CC range. Still, after making an ample reduction for the costly extra notes below, a sum remains that is far beyond what an English organ-builder is sometimes supposed to be fairly entitled to in the present day for a similar amount of work. We need not wonder, then, at the completeness, so far as they went, goodness of material, excellence of finish, beauty of tone, and durability of old instruments made under such favourable auspices.

1269. For the organ in the church of St. Vincent de Paul (40 sounding-stops), at Paris, Cavaillé-Coll received £2,000; and for that at the Madelaine (48 sounding-stops), £2,500. The above matters relating to the price, excellence, and completeness of an organ, have been entered into thus fully and unreservedly in this place, first, because, emanating as they do from one who is wholly unconnected with the organ-building business, and who, therefore, can in no way be interested in the issue, beyond what is shared by all who admire excellence, irrespective of size, they may perhaps be permitted to exercise some influence with those who have to detect the actual merits of competing estimates; and, secondly, because they really involve the permanent interest of the purchaser, the credit of the builder, and the progress of the art in equal degrees. It need only be added that a builder of high reputation will naturally expect, and will be entitled to receive, higher remuneration for his work than one of less eminence.

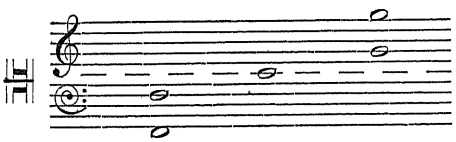
CHAPTER XXXIX.

PLANS FOR ORGANS OF VARIOUS SIZES.

1270. SOME plans or specifications for organs of various sizes will now be given, which will illustrate the several rules that have been explained in detail in preceding chapters of this book; and will also serve to show by what easy and successive steps an instrument may be gradually developed from a small chancel or school-room organ into a large cathedral or town hall organ, without any of the primary laws of the science being overturned or modified in any way. In their preparation, the schemes of the best English and foreign organs, of old as well as of recent times, have been consulted, and their best features embodied, so far as has been found practicable, or seemed to be in accordance with the requirements of a modern English organ. As, however, nearly every organ-builder and organist has his predilection in favour of particular stops, some of the details of the following specifications would, of course, be modified to adapt them to particular tastes.

POSITIF ORGANS.

1271. Before entering upon these several matters, a few words may be said on a kindred subject. The question has frequently been raised as to the most economic mode of using the funds and space—both usually too limited—that may be available for organs for small village and mission churches, and where the use of the instrument will only be needed as an accompaniment to simple vocal harmony. For an organ built for the *sole* purpose indicated, and under the close restrictions mentioned, as great a proportion as possible of the small funds should be expended on *pipes*, and as little as possible on *mechanism*; as much on the most efficient attainable production of those notes specially required for the guidance and support of the voices, and as little as possible on anything and everything beyond. The first question, then, that presents itself is that as to the compass that would be sufficient for such an instrument. If we refer back some centuries to the time when the organ could have been used for no other purpose in the church than as an accompaniment to the voices, we find its range agreeing very nearly, if not exactly, with that of the human voice; and that compass is fully represented by the ancient great stave of eleven lines with the notes immediately below and above:—



1272. For an organ for the purpose indicated a compass of three octaves and

a tone—FF to g^3 in alt, 39 notes—would be sufficient. With regard to the stops, it should be mentioned that a single stop, and that in unison with the voices, never can keep the voices in tune long together. Singers find a difficulty in hearing a stop that is in unison with their voices, but readily detect one that sounds in the octave above them. The smallest organ, therefore, should have two stops, a Unison and an Octave. For a small delicate toned instrument there might be—

I.

1. Lieblich Gedact.
2. Dulcet, or Octave Dulciana.

For a two-stop organ of fuller tone the following would be suitable :—

II.

1. Stopped Diapason.
2. Principal, Gemshorn, or Spitzflöte.

For an organ of three stops :—

III.

1. Stopped Diapason.
2. Open Diapason to Middle c^1.
3. Principal.

1273. Father Smith, in numerous small organs, made the Open Diapason to range simply from middle c^1 upwards ; and, as that note marked the full average range downwards of the treble voice, there was a certain completeness and distinctness of adaptibility about the little stop. It is, therefore, proposed above.

IV.

For a four-stop organ the following registers will be quite satisfactory :—

1. Lieblich Bourdon.
2. Open Diapason.
3. Stopped Diapason.
4. Principal.

1274. As the Bourdon appears in these plans for Positif organs for the first time in the foregoing, a few words may be said in reference to that stop. Deep-sounding bodies generate large and ample sound-waves ; and large sound-waves exercise an impressive effect on the feelings of auditors within their influence. In drawing up plans for small organs, advantage should be taken of this fact to introduce those deep-sounding bodies as soon as practicable, that they may exercise on those engaged in acts of devotion the wholesome influence just adverted to.

1275. The Bourdon be made to the small scale, and voiced to the sweet tone implied by the adjunct "Lieblich," it will be found to enrich and deepen the general tone, without obscuring or disputing the predominance of the unison pitch. The compass of the above organ is supposed to be the same as before ; but as the pipes to the keys in the *upward* direction would be small and inexpensive, and yet would be most useful in a variety of ways, the range might be continued another octave, as being everything short of a *necessity*. The first and most obvious use of

the upper octave of keys would consist in its being available for playing the melody "in octaves" when the voices might be showing a tendency to get flat, and of its thus offering an ever-ready means of checking such tendency without the player having to remove a hand from the Manual to draw the Octave stop.

1276. The extra octaves of keys would, in conjunction with the Bourdon, admit of a very pretty combination, resembling that produced by the Stopped Diapason and Flute on ordinary organs.

1277. A desire is sometimes evinced to have introduced, into organs even of the very small kind under consideration, the movement called by the Spanish organ-builders of the last century "Terzo Mano," and by Mr. Holditch, who introduced it into England, "Diocton." It is a question whether it be advisable to introduce any mechanical appliance whatever into so small an organ. If, however, its insertion be proposed, some care will be required as to the selection of the stops. The effect of an "octave coupler," it may be as well to explain, is to repeat all the sounding stops at *half size*, and add them in that new form to the stops in their actual size. There is a great risk, therefore, of the 4-feet tone being made to exceed the 8-feet tone by a movement of the above kind, and of the general tone becoming top-heavy. If an octave coupler be desired, the stops in their half size, as well as their full, should be written down, and the size and proportion of the whole then tested. No scheme of four stops will bear this trial better than the following :—

V.

1. Bourdon . . 16.
2. Open Diapason 8.
3. Dulciana . . 8.
4. Flute . . . 4.

"Reproduced" as above, the scheme would stand thus :—

VI.

1. Bourdon . . . . . 16.
2. Open Diapason. . . . . 8.
*3. Stopped Diapason. . . . . 8.
4. Dulciana . . . . . 8.
*5. Principal . . . . . 4.
6. Flute . . . . . 4.
*7. Dulcet . . . . . 4.
*8. Piccolo. . . . . 2.

That is to say, like one stop 16 feet, three of 8 feet, three of 4 feet, and one of 2 feet.

For an organ capable of sustaining some hundreds of voices the following five stops would be good :—

VII.

1. Bourdon.
2. Open Diapason.
3. Stopped Diapason.
4. Principal.
5. Mixture, II ranks—12 and 15.

These organs might well be distinguished as *Positif Organs*, as that is not only

the old English name for small instruments, but is one that has not hitherto been appropriated in modern days.

CHANCEL ORGANS.

1278. Another kind of small organ is appropriately called the Chancel organ. This consists of at least one Manual of full compass, and a good complement of pedals ; and two stops at the least, one of 8 feet and one of 4.

For a delicate toned organ of this kind the following stops would answer well :—

VIII.

Manual compass CC to g^3, 56 notes. Pedal CC to d^1, 27 notes.

1. Lieblich Gedact . . . . . 8 feet tone.
2. Dulcet . . . . . 4 feet.

For a somewhat fuller tone :—

IX.

Compass as before.

1. Stopped Diapason . . . . . 8 feet tone.
2. Gemshorn. . . . . 4 feet.

For a stronger tone the following three stops :—

X.

1. Stopped Diapason . . . . . 8 feet tone.
2. Open Diapason to Middle c^1 . . . . 8 feet.
3. Principal . . . . . 4 feet.

For an organ of six sounding stops the following would answer well :—

XI.

Manual Organ.

1. Open Diapason . . . . . 8 feet.
2. Stopped Diapason. . . . . 8 feet tone.
3. Dulciana to tenor c, grooved into No. 2 below . . . . . 8 feet.
4. Principal . . . . . 4 feet.
5. Mixture, II ranks . . . . . 12 and 15.

Pedal Organ.

6. Bourdon, CCC to tenor d, 27 notes 16 feet tone.

1279. In drawing up plans for organs, however small, advantage ought to be taken of the experience and successful experiments of the early builders and their successors, and to propose, as soon as practicable, not only the tone *to* CC, but below them as far as FFF, to obtain a greater or less number of which the makers of past times did not hesitate to depart from what they knew to be the proper compass, rather than lose those tones altogether. Without those tones *somewhere*, all the simple church music, written in the scales of B flat, A, G, and F, forming a considerable portion of the whole, would be

deprived of its deep-toned tonic, as well as many of its grave-sounding progressions. In the above plan for a Chancel organ the Manual presents the range not only indispensable for an accompaniment organ—like the Positifs, already proposed—but also the compass necessary for the unfettered study and practice of the *Manual* parts of the greatest works ever written for the instrument; while the Pedals present not only the deep tones necessary to afford a satisfactory interpretation of any of the bass progressions of vocal church music, but likewise the still freer parts of essentially church organ music. This subject cannot be followed any further in this place. Probably it may be treated of more fully in a separate form of publication.

CHURCH ORGANS.

1280. The next subject to be touched upon is the smallest kind of church organs, from which point the subject may be continued forward uninterruptedly.

XII.

For a small organ of two Manuals and Pedal and 10 sounding stops :—

Great Organ.

1. Open Diapason . . . 8 feet.
2. Stopped Diapason . . 8 feet tone.
3. Dulciana to tenor c, grooved into No. 2 below . . . . . 8 feet.
4. Principal.

Swell Organ.

5. Violin Diapason, or Spitzflöte, to tenor c, grooved into No. 6 below . . . . . 8 feet.
6. Rohr-gedact . . . . 8 feet tone.
7. Violino, or Gemshorn . 4 feet.
8. Mixture, II ranks, 12 and 15 . . . . . $2\frac{2}{3}$ feet.
9. Oboe . . . . . 8 feet.

Pedal Organ.

10 Stopped Bass . . . . . 16 feet tone.
Bass Flute, 8 feet tone by means of octave coupler.

Accessory Stops, Movements, &c.

1. Swell to Great.
2. Swell to Pedal.
3. Great to Pedal.
4. Octave Coupler, Pedal.

1281. An "octave coupler," to produce the effect of a "Bass Flute," is proposed for the Pedal. A stop of this kind is very useful, even when the extra octave of pipes, to complete its upward compass, is not attainable, as is supposed to be the case in the present instance. The 8-feet "helper" quickly defines the deep tones of the 16-feet octave, and has the advantage of doing this, according to the present plan, without either of the Manuals being coupled to the Pedal for the purpose. The Manuals are thus left free to be used with their own separate and special soft combinations whenever required. The higher tones of the 16-feet range are quite distinct, and not far removed in pitch from the Manual tones; hence the omission of the 8-feet sound is not felt to be material. In place of No. 8 a 2-feet stop of some kind might be substituted,

XIII.

SPECIFICATION FOR AN ORGAN OF TWELVE SOUNDING STOPS, TWO MANUALS, AND PEDAL.

Great Organ.

1. Open Diapason . . . 8 feet.
2. Stopped Diapason . . 8 feet tone.
3. Dulciana to tenor c, grooved into No. 2 below . . . . . 8 feet.
4. Principal . . . . . 4 feet.
5. Flute, Stopped, Open, or Harmonic . . . . 4 feet.
6. Mixture, II ranks, 12 and 15 . . . . . $2\frac{2}{3}$ feet.

Swell Organ.

7. Violin Diapason, Open Diapason, or Spitz-flöte, to tenor c . . 8 feet.
8. Lieblich Gedact. . . 8 feet tone.
9. Violino, Principal, or Gemshorn. . . . . 4 feet.
10. Mixture, II ranks . . $2\frac{2}{3}$ feet.
11. Trumpet, Horn, or Cornopean . . . 8 feet.

Pedal Organ.

12. Stopped Bass . . . . . 16 feet tone.
Bass Flute by means of octave coupler.

1282. A difficulty that frequently attends the planning of a small English organ of two Manuals, on the modern principle, is the satisfactory treatment of the bass or 8-feet octave of the second Manual, or Swell, owing to the size of the stops that are justly considered to be indispensable for even the most limited departments of that kind to possess. In the instance of the second Manual or Choir organ of the instruments of the last century no such difficulty existed, on account of the stop generally selected for that department being comparatively small ones—as Stopped Diapason, 8-feet *tone* (4 feet *literal* length); Principal, 4 feet, and so on; but now that the Swell invariably takes the precedence of the Choir organ, and an Open Metal Flue stop of 8 feet and at least one Reed stop of the same size are required for even the smallest specimen of that division of an organ, the case is very different.

1283. By way of illustrating the extent of this alteration and increase in the size of the stops, the following experiment might be tried on a tenor c Swell, containing the following six stops :—

1. Bourdon . . . . . 16 feet tone.
2. Open Diapason . . 8 feet.
3. Stopped Diapason . 8 feet tone.
4. Principal . . . . . 4 feet.
5. Mixture II ranks . $2\frac{2}{3}$ and 2 feet.
6. Hautboy . . . . . 8 feet.

First, press down the tenor c key, then draw the Bourdon, when a sound like that from a CC Stopped Diapason will be heard. The Open Diapason, when added, will sound like a Principal, the Stopped Diapason like a Flute, the Principal like a Fifteenth, the Twelfth and Fifteenth like a II-rank Mixture, and the Hautboy like a Clarion. Thus it will be exemplified that the tenor c pipes of those six Swell stops are as large as the CC pipes of the following six Choir stops :—

1. Stopped Diapason . . 8 feet tone.
2. Principal . . . . . 4 feet.
3. Flute . . . . . 4 feet tone.
4. Fifteenth . . . . . 2 feet.
5. Mixture, II ranks.
6. Clarionet . . . . 8 feet tone.

That is to say, the Swell stops of a modern organ are ordinarily twice the size of the Choir stops of old organs. This will at once give an idea of the great amount of extra standing-room a Swell must require beyond what is necessary for a Choir organ of the same number of stops, even supposing the necessary additional funds to secure the more costly stops in a complete form to be forthcoming; added to which there is the price of the expensive "large wooden room," or box, to hold them, to be taken into account. A Swell, therefore, with all its stops of complete compass, could scarcely be expected in an organ for so small a church as the above would be calculated; yet, on the other hand, it is very disadvantageous to the effect of the music, as well as unsatisfactory to the player, when the range of the second Manual organ is far short of what it should be.

1284. To overcome this difficulty, the bass octave of the Stopped Diapason and Principal in the Great organ has sometimes been "borrowed;" that is to say, they have been made to act on the corresponding octave of the Swell Manual without the remaining Great organ stops sounding. Something analogous to this in principle used to be effected by Harris, Bridge, and other builders, who, in some of their organs, borrowed the two lower octaves of their "Choir organ" from the Great, as at St. Andrew Undershaft, by means of double grooves, one set for each Manual, and two sliders to each borrowed stop, of which also one was for each Manual. Conveyances or grooves extended from the upper-boards over the one slider to the bass pipes over the other, and small leather valves were placed over each set of sound-board holes to prevent any of the wind that came up from one department of the organ passing down into the other division. The borrowing, however, has been effected in various ways, as, for instance, by partitioning off a small portion of the single sound-board grooves, and providing pallets and sliders as before. All such contrivances are designed to arrive at the same end, though a borrowed bass is far better than the plan of making the Swell keys below tenor c act on the entire Great organ, which is a very primitive device. Another plan has been to introduce a small "Choir bass" to act on the bass octave of the second Manual to meet the Swell. This is a better arrangement still, as the Stopped Diapason bass and Principal, of which it is usually composed, can be scaled and voiced with some reference to the strength of the Swell stops. Still this is not entirely satisfactory, as, of course, it cannot be made to match the Swell stops equally well, whether the Swell-box be open or closed. Of the several methods that have been devised none appear to be open to so little objection as the following.

1285. The Open Diapason might, to save room, be discontinued at the 4-feet c pipe, as in the ordinary tenor c Swell; but the Stopped Diapason could be carried down to CC, the longest pipe of which would even then only be of the same 4-feet *length*, although its sound would be of 8-feet *pitch*. The Principal might also be carried right down, the lowest pipe of which octave stop would even then be no longer than the Open Diapason pipe of the octave above, that is, 4 feet. About the Mixture, smaller again, yet so pretty in its effect, there would be no difficulty. Lastly, the Reed could be mitred down without any detriment to its tone, but rather the contrary, and so be reduced to the 4-feet height. In this way the 8-feet octave of Manual tones could be secured to the Swell without increasing the height of the Swell-box at all, by adding to its breadth to some extent, and to its depth to a less degree, while its sounds would be rendered susceptible of being increased or diminished with the rest of the Swell, which power, of course, cannot be secured by any of the other plans. Within the last few years this plan has been frequently and successfully followed by Foster and Andrews and other organ-builders. The lowest septave of the Principal might be made to draw on the Open Diapason slide, in conjunction

with the bass of the Stopped Diapason, to which it would act as a helper. In that case the Principal, as a separate stop, would not sound below the tenor c key; but, as it is never used as a separate stop without the Diapason, this would practically be no disadvantage. The 8-feet septave of the Stopped Diapason as a bass to the Open always sounds somewhat dull and muffled without some such "helper."

1286. A mistake sometimes finds its way on to the labels of the Pedal couplers which it is worth while to point out. It is generally understood that, of the two claviers named on the label of a coupler, the *first* is that of the row of keys coupled, and the second that of the one to which it is united. Thus, "Swell to Great" is understood to mean that the former is coupled to the latter, which is the case; but with the Pedal coupler the names frequently get reversed, and although the mechanism attaches the Great organ to the Pedal, yet the label announces that it unites the "Pedal to Great."

XIV.

SPECIFICATION FOR AN ORGAN WITH SEVENTEEN SOUNDING STOPS, TWO MANUALS, AND PEDAL.

Great Organ, 9 Stops.

1. Bourdon	16 feet tone.	6. Flute	4 feet tone.
2. Open Diapason . .	8 feet.	7. Twelfth	$2\frac{2}{3}$ feet.
3. Dulciana to Tenor c.	8 feet.	8. Fifteenth	2 feet.
4. Stopped Diapason .	8 feet tone.	9. Mixture, III, IV, or V ranks.	
5. Principal	4 feet.		

Swell Organ, 6 Stops.

10. Open Diapason . .	8 feet tone.	13. Mixture, II ranks .	$2\frac{2}{3}$ and 2 feet.
11. Stopped Diapason .	8 feet.	14. Hautboy	8 feet.
12. Principal	4 feet.	15. Horn	8 feet.

Pedal Organ, 2 Stops.

16. Open Bass	16 feet.	a. Octave Bass (borrowed by means of a coupler)	8 feet.
17. Stopped Bass . . .	16 feet tone.	b. Flute Bass . (borrowed by means of a coupler)	8 feet tone.

Accessory Stops, Movements, &c.	*Compass.*
1. Swell to Great.	Great. CC to g^3 in altissimo, 56 notes.
2. Great to Pedal.	Swell. CC to g^3 in altissimo, 56 notes.
3. Pedal Octave.	Pedal. CCC to Tenor f, 30 notes.

4, 5, 6, 7, 8. Five double-action Composition pedals, to act on the stops of the Great organ in the following manner :—

4, to draw out the Dulciana, and reduce the full organ to the same.
5, to draw out the Diapasons, and reduce the full organ to the same.
6, to draw out to the Fifteenth, and reduce the full organ to the same.
7, to draw out the full organ.
8, to compound a Choir organ by drawing out the Stopped Diapason, Dulciana, Principal, and Flute, and reducing the full organ to the same.

1287. The last Composition pedal mentioned in the above scheme, although but seldom introduced, would prove of the greatest possible use in all small organs which have no separate Choir organ. It was tried for the first time (at the writer's

suggestion) in the organ built by Walker, for Trinity Church, Vauxhall Bridge, in 1852. As a Pedal of the kind does not belong to the series for increasing the strength of the organ tone by gradations from *piano* to *forte*, and for reducing it back again, but is designed to answer a distinct and special purpose, it had better be placed quite apart from the rest, say, to the extreme left, opposite to where the Swell Pedal is usually situated. The Bourdon is proposed to be acted on only by the Composition Pedal that is to draw out the full organ, as its use is not governed by any laws analogous to those which regulate the employment of the other stops, but is sometimes required in soft combinations, while at others it is not desired for much louder ones. For these reasons it will be better for it to be controlled chiefly by the hand.

1288. In many small English organs a Bourdon of 16-feet tone is placed on the second Manual, while all stops of the same pitch are omitted from the first. This is not in accordance with the Continental custom, as will be perceived on referring to any of the specifications of small organs contained in the Appendix.

1289. Two independent Pedal stops are included in the specification last given. Both those stops are proposed to be of 16 feet; Flue stops of that size or size of tone being the most important ones for the Pedal to have first, they forming the "Open and Stopped basses" to the Diapasons of the Manual. Of scarcely less importance are the 8-feet Pedal stops, for which a Pedal octave coupler is proposed, as before.

1290. At the same time, a plan for compounding a second independent stop out of a first has been quite successfully tried by Schulze, Jardine, Wadsworth, Robson, and others. It is as follows:—CCC and CC grooves are placed side by side; the CCC sharp and CC sharp grooves the same; and so on throughout the sound-board; an extra octave being added at the end to complete the 8-feet range. Each Pedal roller is then provided with two lowering arms, one communicating with the CCC pallet, the other operating on a second pallet in the CC groove. On the table are twice the usual number of sliders, say four instead of two; that is to say, in addition to those for the two actual stops, the same number is introduced for the borrowed octaves, and those for the 16-feet stop and the borrowed octave are in each case placed side by side. The CCC and CC pipes also stand side by side on the sound-board, to save conveyancing or grooving; and all the other pipes are arranged in the same manner. By these means the independence of the 8-feet range is so completely established that it is scarcely possible to discover that there are less than twice as many actual stops as really exist.

XV.

SPECIFICATION FOR AN ORGAN WITH TWENTY SOUNDING STOPS, TWO MANUALS AND PEDAL.

Great Organ, 10 *Stops*.

1. Bourdon	16 feet tone.	5. Principal	4 feet.
2. Open Diapason . .	8 feet.	6. Stopped Flute or Harmonic Flute .	4 feet tone.
3. Dulciana, or Gamba, to tenor c . . .	8 feet.	7. Twelfth	$2\frac{2}{3}$ feet.
4. Stopped Diapason, Clarabella, Hohlflöte, or Harmonic Flute	8 feet tone.	8. Fifteenth	2 feet.
		9. Mixture, III, IV, or V ranks	2 feet.
		10. Trumpet	8 feet.

Swell Organ, 9 Stops.

11. Lieblich Bourdon .	16 feet tone.	15. Principal	4 feet.
12. Open Diapason . .	8 feet.	16. Mixture, III ranks.	2 feet.
13. Stopped Diapason .	8 feet tone.	17. Hautboy	8 feet.
14. Keraulophon or Viola	8 feet.	18. Horn	8 feet.

Pedal Organ, 2 Stops.

19. Open Bass . . . 16 feet.	a. Octave Bass {borrowed / as before} 8 feet.
20. Stopped Bass . . 16 feet tone.	b. Bass Flute {borrowed / as before} 8 feet tone.

Accessory Stops, Movements, &c.

1. Coupler Swell to Great.
2. Swell Octave.
3. Coupler Great to Pedal.
4. Pedal Octave.
5, 6, 7, 8, 9. Composition Pedals as before.

Compass.

Great. CC to g^3 in altissimo, 56 notes.
Swell. CC to g^3 in altissimo, 56 notes.
Pedal. CCC to tenor f, 30 notes, with extra octave of organ, to complete the octave range.

1291. In Germany a satisfactory specification for a 10-stop Great organ always includes one Flue stop of 16-feet tone, three or four of 8 feet, two of 4 feet, and a Compound stop of from III to VI ranks. This skeleton scheme cannot be improved upon; and there is the less occasion for even making the attempt, since there is so much room for indulging individual taste in making the selection of stops wherewith to fill it up.

1292. It will be seen that the "Double" in the Great organ is proposed to be stopped throughout (Bourdon), and not open in the tenor and treble, as it is sometimes made in England. The Continental rule is that when there is but one stop of 16-feet pitch on a Manual that should be a covered stop (see Specifications in Appendix); and to this rule very few exceptions indeed exist. A Bourdon or kindred stop is first introduced, because it is more prompt in its speech than a Double Open Diapason; because it deepens the organ tone so admirably, without rendering the sub-octave sound so weighty and sonorous as to confuse it with the unison pitch in soft combinations; and because it is the less expensive stop, and also requires less standing and speaking room. For these several reasons its adoption has been recommended above. Sometimes a Quintaton, 16 feet (Fifth-sounding covered stop, 16-feet size of tone) is found proposed in foreign specifications. A stop of the kind is not designed to give its actual tone purely, but to produce its twelfth, of $5\frac{2}{3}$-feet, as strongly as its ground tone. The original design of such a stop is to obtain the effect of two from one rank of pipes, on which account the stop in question is in Germany termed a "simple mixed stop." It, of course, is never intended to be used by itself.

1293. The Flute on the Great Manual of the organ at Hampton Court, by Father Smith, is really a Quintaton of 4-feet ground tone. It is formed of metal pipes, with metal caps *without* chimneys.

1294. A Swell octave coupler is proposed above, that is, one to unite the Swell to itself in that interval. A movement of this kind is very useful for solo playing in the middle and tenor octaves, as *either* reed can then have its 4-feet effect brought into conjunction with its 8-feet. Moreover, where the Swell is coupled to the Pedal, a very excellent effect, by additional distinctness, is imparted to the latter by it. Lewis has introduced this very successfully into some of his recent instruments.

XVI.

SPECIFICATION FOR AN ORGAN OF TWENTY-EIGHT SOUNDING STOPS, THREE MANUALS, AND PEDAL.

Great Organ, 10 *Stops*.

1. Bourdon	16 feet tone.	6. Stopped Flute, or Flute Harmonic .	4 feet tone.
2. Open Diapason . .	8 feet.	7. Twelfth	$2\frac{2}{3}$ feet.
3. Spitzflöte, or Gamba.	8 feet.	8. Fifteenth.	2 feet.
4. Stopped Diapason, Metal Treble, Clarabella, or Hohlflöte	8 feet.	9. Mixture, III, IV, or V ranks	2 feet.
5. Principal.	4 feet.	10. Trumpet.	8 feet.

Swell Organ, 9 *Stops*.

11. Lieblich Bourdon. .	16 feet tone.	16. Mixture, III and IV ranks	2 feet.
12. Open Diapason . .	8 feet.	17. Hautboy.	8 feet.
13. Rohr Gedact . . .	8 feet tone.	18. Horn	8 feet.
14. Principal	4 feet.	19. Clarion	4 feet.
15. Fifteenth	2 feet.		

Choir Organ, 5 *Stops*.

20. Dulciana. . . .	8 feet.	23. Flute	4 feet tone.
21. Lieblich Gedact . .	8 feet tone.	24. Clarionet, to tenor c	8 feet.
22. Principal, or a Taper stop	4 feet.		

Pedal Organ, 4 *Stops*.

25. Open Bass	16 feet.	27. Principal Bass. . .	8 feet.
26. Stopped Bass . . .	16 feet tone.	28. Posaune, wooden tubes	16 feet.

Accessory Stops, Movements, &c.	*Compass.*
1. Swell to Great.	Great. CC to g^3 in altissimo, 56 notes.
2. Great to Pedal.	Swell. CC to g^3 in altissimo, 56 notes.
3. Choir to Pedal.	Choir. CC to g^3 in altissimo, 56 notes.
	Pedal. CCC to tenor f, 30 notes.

4, 5, 6, 7. Four double-action Composition Pedals to act as follows :—

4, to draw out Diapasons (2, 3, and 4), and reduce full organ to the same.
5, to draw out to Fifteenth, and reduce full organ to the same.
6, to draw out full organ without Reed, and draw in Trumpet.
7, to draw out full organ.

1295. The effect of a second Open Diapason has generally been to increase the quantity of smooth unison tone. Most English organs of the size represented in the preceding specification used to contain the repetition in question ; whereas very few of the Continental instruments include any such duplication of the equivalent stop, *i.e.*, of the "Principal, Prestant, or octave of 8 feet." The organs at Rotterdam, Freiburg, and Tours, offer exceptions to the rule, which, however, are all much larger instruments. (See Foreign Specifications.) It might, therefore, be supposed that the foreign organs do not contain any stop

corresponding with the English "second Open;" which inference, however, would only be correct so far as the *name* is concerned, for they very generally do possess a second Unison Open Metal Flue stop of rather strong tone. It is true, indeed, that they usually present but one "Principal, or *most* important stop of 8 feet," which, forming the basis from which the length and scale of the whole series of harmonic corroborating stops are calculated, thus constitutes the *Diapason* thereto; but then they have, in lieu of a second stop of that same name and size, some member of the Flute-work, which is selected according to the character of tone it is desired the "second Open" shall produce.

1296. The point of difference, therefore, in this particular, between the English and the Continental system is this: that whereas in this country the second open stop is almost always labelled "Open Diapason," although its tone may differ much, and advantageously so, from the full and sonorous character of that of the first stop of the same name; in Germany, the several varieties of tone are, on the contrary, produced from as many different kinds of stops, each of which has something peculiar in its *form* to distinguish it to the organ-builder, something special in its *tone* to distinguish it to the auditor, and something distinct in its *name* to distinguish it to the organist. Thus, in some German organs, we find a "second Open," slightly conical in form, producing a rather lighter tone than the first, of a slightly flutey quality, and bearing the inscription "*Spitzflote 8 feet.*" In others, we find the second 8-feet open stop more conical than the last-mentioned, producing a clear, piping, and chirping quality of tone, and labelled "*Gemshorn 8 feet.*" Other organs contain a second open stop that is more or less reedy in tone, and smaller in scale, bearing the name *Gamba, Salicional, Geigen Principal,* &c., as the case may be. Any Specification in the Appendix may be referred to for an illustration of these particulars.

1297. The origin of the introduction of a second Open Diapason into the English organ is possibly connected in some way with the custom, prevalent in the seventeenth century, of erecting the organ on the choir screen, which rendered a "double front" necessary, demanding two sets of *cylindrical* pipes wherewith to adorn them. And it is worthy of observation that, although Father Smith frequently introduced "two Opens," he generally voiced the smallest one so that it produced a tone partaking in some degree of the peculiar flutey quality of the German *Spitzflöte.* The custom of introducing two Open Diapasons has prevailed very generally in England, from the time of Smith and Harris down to our own. The fault generally was that they did not possess sufficient individuality of tone, nor, consequently, the amount they might have done when combined.

1298. The particular in which the English system is felt to be insufficient is in its not possessing any nomenclature whereby the stops producing the several characters of tone can be distinguished and specially referred to. That the adoption of something of the kind would prove advantageous, there can scarcely be a second opinion. All must have experienced the convenience of being able, for instance, to distinguish a Dulciana from an Open Diapason by a *name* instead of a *description,* and a Keraulophon from both by the same simple means. Perhaps "smooth Open" and "clear Open" would be sufficiently definite for the purpose.

1299. The second Open Diapason is sometimes, indeed, labelled "*small* Open;" but this addition only refers to the *scale* of the stop, and not to the *quality* of its sound, which may vary considerably in different examples. Moreover, one builder's "small" Open will not unfrequently nearly equal in size

the "large" Open of another. What the performer requires most especially is a key to the tone-character of the stop; and, if some special term could be applied to every stop, the sound of which differed from that of the actual "Diapason," such a series of names would doubtless prove most acceptable. Under this impression, the second Unison Open stop on the Great Manual of the last specification is marked "Spitzflöte 8 feet;" for which, however, some other 8-feet stop could be substituted, or even the hitherto usual English stop and terminology, if preferred.

1300. In selecting the particular kind of Stopped Diapason and Flute for the Great and Choir Manuals, a better opportunity is afforded for the exercise of individual choice than is the case with almost any other class of stops in an organ. It was a frequent custom with the younger Harris to make the Treble of his Choir Stopped Diapason and Flute of metal, as in the late Doncaster organ; while the younger Smith as often made his both of wood throughout, as at Finedon. The elder Smith, on the contrary, frequently made the two stops of a different kind of material; so that if the Stopped Diapason was of wood, the Flute would be of metal; and when the Stopped Diapason was of metal, the Flute was of wood. In a few cases he made the one Stopped and the other Open, as in the Durham Cathedral organ, where to a Stopped Diapason of wood on the Great and Choir organs a Hohlflöte of octave pitch was placed in each instance.

1301. The "crossing" of the Stopped Diapason and Flute, in regard to their material, after the manner adopted by the elder Smith, has long been a prevalent practice, though by no means an invariable one, with the German organ-builders. It was followed by Silbermann in his fine instruments at Dresden, in the Choir organs of each of which it will be seen, on referring to their Specifications in the Appendix, that to a "Gedact of 8-feet tone" he introduced a "Rohrflöte of 4-feet tone." It will be noticed, also, that to the "Gedact of 8-feet tone" in the Choir he in each case disposed a "Rohrflöte of 4-feet tone" in the Great organ.

1302. By making one of the covered stops on the same Manual of wood, and the other of metal, greater individuality of character in the tone is obtained from each than is usually secured by the voicing alone; and by making two stops of similar nature on two different Manuals—as, for instance, the Stopped Diapasons on the Great and Choir organs—of different materials, a nice, mild contrast is caused to exist even between stops which (in England, at any rate) usually bear the same name. Much variety is also to be obtained by crossing the Clarabella of 8 feet and the Flute Harmonic of 4 feet; also by the use of the Rohrflötes, Gedacts, and the numerous Flutes that have been invented or introduced within the last few years.

1303. The plan of making the covered stops of 8 and 4 feet tone "cross" was adopted by the late Mr. Hill for the Choir organ of his instrument at the Panopticon, and also by the late Mr. Walker.

1304. It is the nature of all good stops of Flute quality of tone, whether they be stopped or open, metal or wood, to impart to the metal tone of those members of the Diapason-work with which they sound in unison a certain fulness and mellowness of effect not attainable without them; and this mollifying influence is exercised to the most beneficial extent when the Flute sound is fully proportioned to that of the metal, yet without being so strong as to prevent its mixing perfectly with, and merging, as it were, in the metal tone. For an organ that is to be lightly and sweetly voiced, somewhat after the Green model, for instance, a Stopped Diapason and Stopped Flute would answer

best; as a Clarabella and Flute Harmonic would in that case be likely to produce rather a "hooting" effect through the light foundation and chorus-work. Instead of simply imparting body and breadth to the Open Diapason and Principal, they would tend to obscure the predominance and "glisten" of the metal quality by their nearer equality of strength, and would thus serve only to thicken and deaden the tone. But, if the Diapason and Harmonic series of stops are to be boldly and fully voiced, a Clarabella and Flute Harmonic might be advantageously introduced; for the reasons that, while they would be covered by the peal of the ringing Mixtures, they would in their turn assist in supporting them by the broader effect which they would impart to the unison and octave sounds.

1305. The Clarabella is generally of excellent quality in the upper octave and a half of its compass, being clear and smooth, yet powerful; but in the middle octave its tone is sometimes thick and woody, probably on account of the largeness of its scale, and its not being blown sufficiently. In the German equivalent for the above-named English stop—the Hohlflöte—the pipes increase in bulk far more gradually downwards, yet the most perfect evenness of quality is preserved.

1306. A singular mistake is sometimes made in the labelling of the Swell octave coupler, which it is necessary to notice. The coupler in question is frequently marked *super*-octave, which means not "the octave above," but "above the octave," and therefore indicates that it operates in the 2-feet pitch, whereas it in reality acts in the *single* octave or 4-feet pitch. This error is the more confusing where the terms octave or super-octave are applied to any of the 4 or 2-feet organ stops.

XVII.

SPECIFICATION FOR AN ORGAN OF TWENTY-FOUR SOUNDING STOPS, TWO MANUALS, AND PEDAL.

Great Organ, 12 *Stops*.

1. Bourdon . . . . . 16 feet tone.
2. Open Diapason . . . 8 feet.
3. Dulciana . . . . . 8 feet.
4. Stopped Diapason or Clarabella . . . . 8 feet tone.
5. Principal . . . . . 4 feet.
6. Harmonic Flute . . 4 feet tone.
7. Twelfth . . . . . $2\frac{2}{3}$ feet.
8. Fifteenth . . . . . 2 feet.
9. Harmonic Piccolo . . 2 feet.
10. Mixture, V ranks . . 2 feet.
11. Trumpet . . . . . 8 feet.
12. Clarionet . . . . . 8 feet tone.

For No. 9 a Gamba might be substituted.

Swell Organ, 10 *Stops*.

13. Bourdon . . . . . 16 feet tone.
14. Open Diapason . . . 8 feet.
15. Rohr Gedact . . . . 8 feet tone.
16. Gamba to tenor c . . 8 feet.
17. Principal . . . . . 4 feet.
18. Fifteenth . . . . . 2 feet.
19. Mixture, III and IV ranks . . . . . 2 feet.
20. Hautboy . . . . . 8 feet.
21. Horn . . . . . 8 feet.
22. Clarion . . . . . 4 feet.

For No. 18 a Flute or a Flageolet might be substituted.

Pedal Organ, 4 Stops.

23. Open Bass, wood . . 16 feet.	25. Principal Bass, metal . . 8 feet.
24. Stopped Bass, wood . 16 feet tone.	26. Posaune, wooden tubes . . 16 feet.

Accessory Stops, Movements, &c.	*Compass.*
1. Swell to Great.	Great. CC to g^3 in altissimo, 56 notes.
2. Great to Pedal.	Swell. CC to g^3 in altissimo, 56 notes.
3. Swell to Pedal.	Pedal. CCC to tenor f . . 30 notes.
4. Swell Octave.	
5. Swell Sub-octave.	

6, 7, 8, 9. Four Composition Pedals, as before.

1307. The Piccolo, which now appears in the Great Organ Specifications for the first time, completes the Flute or wood organ, consisting of the Bourdon, Stopped Diapason, Flute, and Piccolo—a series of stops of the greatest service for purposes of accompaniment and for solo playing. A Harmonic Piccolo or Flageolet of 2 feet might take the place of the wood stop, if preferred.

1308. The Octave and Sub-octave Couplers are sometimes made to attach the "Swell to Great;" at others they unite the Swell to itself in the octave above and below. In the latter case, the octave sound, each way, can be concentrated on a single Swell key, provided the octave be within the standard compass of the Manual. The Octave and Sub-octave Swell Couplers are then freely available, without the independence of the Great organ being *of necessity* lost for the time being. If either the Octave or the Sub-octave effects, or both, were required *in conjunction* with the Great, they are then obtainable by drawing the usual Coupler Swell to Great; when, of course, every key united *to the Swell unison* would also descend on that key, being drawn down by the corresponding key of the Great organ. The only effect lost is that of attaching the Swell to the Great in the Octave and Sub-octave *without* the Swell unison.

1309. Several excellent Pedal effects are placed at the organist's command, when the Swell unites to itself. For instance, the Swell—with the "Swell Octave" drawn—on being coupled to the Pedal, would, by means of the Clarion, produce the effect of a 2-feet Reed, and thus impart to the Pedal entry of a subject a great amount of point and brightness; or, with the Sub-octave drawn, which would attach the CC Swell key to the second c of the Pedals, and consequently bring the 16-feet CCC Bourdon *tone* on to the same CC Pedal, the effect of a light Pedal stop of 32-feet tone would be obtained through the octave and a half of the Pedal range from that key upwards.

1310. Octave and Sub-octave Couplers occur in most of the Italian organs, whether of ancient or recent date. It would be interesting to know positively the exact period of the introduction of such useful movements. The Unison Coupler would naturally be the first kind thought of; and, from the prominent way in which that description of accessory stop is mentioned in the old account of the Lucerne organ (Foreign Specifications), it is not improbable that a clavier coupler was, at the period of the construction of that instrument (1561), then either a new feature or a great novelty in the science.

XVIII.

SPECIFICATION FOR AN ORGAN OF THIRTY-SIX SOUNDING STOPS, THREE MANUALS, AND PEDAL.

Great Organ, 13 *Stops.*

1. Bourdon . . . . . 16 feet tone.
2. Smooth Open Diapason . . . . . 8 feet.
3. Clear Open Diapason . 8 feet.
4. Stopped Diapason, Clarabella, or Hohlflöte . . . . . 8 feet tone.
5. Principal . . . . . 4 feet.
6. Stopped Flute, or Flute Harmonic . . 4 feet tone.
7. Twelfth . . . . . $2\frac{2}{3}$ feet.
8. Fifteenth . . . . . 2 feet.
9. Piccolo . . . . . 2 feet.
10. Full Mixture, III ranks . . . . . 2 feet.
11. Sharp Mixture, III, IV, or V ranks . or 2 feet.
12. Trumpet . . . . . 8 feet.
13. Clarion . . . . . 4 feet.

For No. 10 a Gamba might be substituted.

Swell Organ, 10 *Stops.*

14. Bourdon . . . . . 16 feet tone.
15. Open Diapason . . . 8 feet.
16. Stopped Diapason, metal treble. . . . 8 feet tone.
17. Bell Gamba . . . . 8 feet.
18. Principal . . . . . 4 feet.
19. Fifteenth . . . . . 2 feet.
20. Mixture, IV ranks . . $1\frac{1}{3}$ foot.
21. Hautboy . . . . . 8 feet.
22. Horn . . . . . 8 feet.
23. Clarion . . . . . 4 feet.

Choir Organ, 7 *Stops.*

24. Open Diapason . . . 8 feet.
25. Stopped Diapason, wood . . . . . 8 feet tone.
26. Dulciana . . . . . 8 feet.
27. Spitzflöte . . . . . 4 feet.
28. Metal Flute . . . . 4 feet tone.
29. Gemshorn . . . . . 2 feet.
30. Clarionet to tenor c . 8 feet tone.

a—Pedal Organ, 6 *Stops.*

31. Open Bass, wood . . 16 feet.
32. Stopped Bass, wood . 16 feet tone.
33. Great Quint Bass, wood, stopped . . . $10\frac{2}{3}$ feet tone.
34. Principal Bass, metal . 8 feet.
35. Flute Bass, wood . . 8 feet tone.
36. Posaune, wooden tubes 16 feet.

b—Pedal, 6 *Stops.*

1. Open Bass . . . . 16 feet.
2. Stopped Bass . . . 16 feet tone.
3. Quint Bass . . . . $10\frac{2}{3}$ feet tone
4. Principal Bass . . . 8 feet.
5. Mixture, II ranks, 12 and 15 . . . . . $5\frac{1}{3}$ feet.
6. Posaune . . . . . 16 feet.

c—Pedal, 6 *Stops.*

1. Open Bass . . . . 16 feet.
2. Principal Bass . . . 8 feet.
3. Fifteenth Bass . . . 4 feet.
4. Posaune . . . . . 16 feet.
5. Trumpet . . . . . 8 feet.
6. Clarion . . . . . 4 feet.

Accessory Stops, Movements, &c.

1. Coupler Swell to Great.
2. Swell Octave.
3. Swell Sub-octave.
4. Choir to Great.
5. Great to Pedal.
6. Swell to Pedal.
7. Choir to Pedal.
8, 9, 10, 11. Four Composition Pedals to Great.
12, 13. Two Composition Pedals to Swell.

Compass.

Great, CC to g^3 in altissimo, 56 notes.
Swell, the same.
Choir, the same.
Pedal, CCC to tenor f, 30 notes.

1311. Three distinct plans are given for a Pedal of 6 stops in the foregoing specification. The first contains a Great Quint Bass, of 10⅔-feet tone, which stop, though but little used in England, is capable of great effect. Many German and Flemish organs produce a mild, yet distinct, 32-feet tone from a Pedal organ, which, nevertheless, contains no stop of that pitch. The sounds which would be supposed to proceed from such a stop are in reality only an "acoustical illusion," resulting from the introduction of a stop of the above kind; every *third* vibration of which coinciding with every *second* vibration of the 16-feet stops and with every *fourth* vibration of the 8-feet stops together, so reinforce the periodical vibrations which occur thirty-two times in a second, that they produce the effect above mentioned. Where room and expense are objects, and no Sub-Bourdon is therefore obtainable, the above plan of obtaining the deepest musical tones, by making the phenomenon of sub-harmonic sounds subservient to practical use, might advantageously be adopted, particularly as the additional stop necessary to produce them is of no greater length than the Pedal Twelfth.

1312. The second plan for a 6-stop Pedal organ is a favourite English scheme; while the third is almost a literal reproduction of one held in high esteem by Silbermann and other German builders. (See Specifications in Appendix.) The first of the three schemes appears, on the whole, to be the best adapted for the accompaniment of the English Church Service, whether choral or congregational; while the second unquestionably would form the best chorus organ. In many Continental churches the Canto Fermo, or melody of the old church chant, thundered forth in unison by a large choir of priests, is made the *bass* in the accompaniment, the harmony appearing as a kind of superstructure, the effect of which arrangement of the parts is frequently most commanding. For this kind of use the third specification, with its three octaves of Reeds—16, 8, and 4 feet—would be the best, it being equal to the production of most impressive effects when employed in this manner.

1313. The consideration of the above three Pedal specifications offers a striking illustration of the immeasurable superiority of the system of organ-building which treats the Pedal as an independent department of an organ over that which recognises the extension of the Manuals down below CC as a substitute for it. In the former case several plans, consisting of the same number of stops, but very dissimilar in their selection, each possessing merits of its own, and each specially adapted to answer a distinct end, can be prepared, and from these a final selection be made, according to special requirements; whereas in the latter this is not possible, for the very existence of the Pedal as an independent and important division of an organ is then scarcely recognised.

XIX.

SPECIFICATION FOR AN ORGAN OF FIFTY SOUNDING STOPS, THREE MANUALS, AND PEDAL.

Great Organ, 17 Stops.

1. Double Open Diapason	16 feet.	9. Stopped Flute, wood	4 feet tone.
2. Bourdon	16 feet tone.	10. Twelfth	2⅔ feet.
3. Open Diapason	8 feet.	11. Fifteenth	2 feet.
4. Spitzflöte	8 feet.	12. Piccolo*	2 feet.
5. Stopped Diapason, metal Treble	8 feet tone.	13. Full Mixture, III ranks	2 feet.
6. Quint	5⅓ feet.	14. Sharp Mixture, V ranks	1⅗ foot.
7. Principal	4 feet.	15. Double Trumpet	16 feet.
8. Gemshorn	4 feet.	16. Posaune	8 feet.
		17. Clarion	4 feet.

* Or another 8 feet stop.

Swell Organ, 12 Stops.

18. Bourdon . . . . . 16 feet tone.
19. Open Diapason . . 8 feet.
20. Stopped Diapason . 8 feet tone.
21. Gamba to tenor c . 8 feet.
22. Principal . . . . . 4 feet.
23. Flute . . . . . 4 feet.
24. Twelfth* . . . . . $2\frac{2}{3}$ feet.
25. Fifteenth . . . . . 2 feet.
26. Mixture, IV ranks . . $1\frac{1}{3}$ foot.
27. Hautboy . . . . . 8 feet.
28. Horn . . . . . 8 feet.
29. Clarion . . . . . 4 feet.

* Or a Vox Angelica.

Choir Organ, 10 Stops.

30. Lieblich Bordun . . 16 feet tone.
31. Spitzflöte . . . . . 8 feet.
32. Lieblich Gedact . . 8 feet tone.
33. Dulciana to tenor c . 8 feet.
34. Keraulophon to tenor c . . . . 8 feet.
35. Gemshorn . . . . . 4 feet.
36. Lieblich Flöte . . . 4 feet tone.
37. Flute Harmonic . . 4 feet.
38. Mixture, II ranks* . . $2\frac{2}{3}$ feet.
39. Corno di Bassetto, throughout . . . . 8 feet tone.

* Or a Flageolet or Piccolo.

Pedal Organ, 11 Stops.

40. Sub-Bass, Stopped or Open . . . . . 32 feet.
41. Open Bass, wood . . 16 feet.
42. Violone . . . . . 16 feet.
43. Stopped Bass, wood . 16 feet tone.
44. Quint Bass, Stopped $10\frac{2}{3}$ feet tone.
45. Principal Bass, metal 8 feet.
46. Flute Bass, wood . . 8 feet tone.
47. Twelfth and Fifteenth Bass . . . . . $5\frac{1}{3}$ feet.
48. Trombone . . . . 16 feet.
49. Trumpet . . . . . 8 feet.
50. Clarion . . . . . 4 feet.

Accessory Stops, Movements, &c.

1. Coupler Swell to Great.
2. Coupler Choir to Great.
3. Swell Octave.
4. Swell Sub-octave.
5. Great to Pedal.
6. Swell to Pedal.
7. Choir to Pedal.
8. Pedal Ventil.
9. Tremulant to Swell.
10, 11, 12, 13. Four Composition Pedals to the Great organ.
14, 15. Two Composition Pedals to the Swell organ.

Compass.

Great, CC to g^3 in altissimo, 56 notes.
Choir the same.
Swell, CC to g^3 in altissimo, 56 notes.
Pedal, CCC to tenor f, 30 notes.

As a solo organ to the above, the following four stops would form a good addition to be operated upon by a fourth Manual :—

1. Diapason Harmonic 8 feet.
2. Flute Harmonic . . 4 feet.
3. Tuba . . . . . 8 feet.
4. Tuba Clarion . . . 4 feet.

There should in that case be two extra couplers, namely, one to unite "Solo to Great," and a second to attach "Solo to Pedal."

1314. A German Great Manual organ, containing 16 stops, is usually furnished with two or three stops of 16 feet, a Quint, and two metal Open Flue stops of 4 feet. All these excellent features are embodied in the plan for the Great organ department of the preceding specification. The Great organ has, in fact, now become strictly a "16-feet" organ. Two Principals, like two Open Diapasons, have frequently been introduced into large English organs, as in the fine instruments at St. Sepulchre's, Snow Hill; Temple Church; Christ Church, Spitalfields; Hereford Cathedral, &c.; and, when there is much Mixture work above, a second stop of the kind, or nearly allied to it, is a most advisable one for an organ to have, as it strengthens the medium tone of the instrument materially. As, however, German organ-builders seldom "repeat themselves," the second 4-feet open metal stop in their specifications is never a repetition of the Principal, but frequently a member of the taper Flute-work, as a Gemshorn or a Spitzflöte of 4 feet. Sometimes the stop in question is an octave to the 8-feet stop, occupying the position corresponding to our second Open Diapason; sometimes, however, the Spitzflöte and Gemshorn "cross" after the manner of the Stopped Diapason and Flute, as already detailed; *i.e.*, if the 8-feet stop be a Gemshorn, the 4-feet will be a Spitzflöte. The latter plan is the most highly esteemed in Germany, and is therefore suggested above.

1315. But the above Great organ specification contains 17 stops. This number has been preferred, since it allows of the incorporation of the Piccolo of 2 feet, which stop is less highly esteemed in Germany than in England or France, and therefore does not usually appear on the 16-stop Great manuals of the former country.

1316. As the full-compass Swell presents a second complete Manual organ composed of cylindrical stops, a few stops of tapering outline might be proposed for the Choir organ, for the purpose of obtaining greater individuality of tone, if preferred. Thus a Spitzflöte of 8 feet and a Gemshorn of 4 feet have been suggested in lieu of the usual Open Diapason and Principal. In some German organs the taper Flute-work of the Choir is made to "cross" that of the Great organ, after the manner of the covered work. Thus, if the Great has a Spitzflöte of 8 feet and a Gemshorn of 4 feet, the Choir would have a Gemshorn of 8 feet and a Spitzflöte of 4 feet; so that there are many ways of varying a specification with good effect. A stop of 8 feet of string tone, as a Gamba, Salicional, Viol d'Amour, &c., might be proposed for the Choir organ, if preferred.

1317. It is a rule with German organ-builders that, when a Pedal organ contains 10 stops, it should include a stop of 32-feet size, or size of tone. Sometimes a stop of that pitch occurs even in a Pedal of 7 or 8 stops. A Mixture, however, is seldom included in a 10-stop German Pedal.

1318. Most German Pedals of 4 stops and upwards contain a "Violone of 16 feet." This is a particularly fine stop, and one of which several good specimens by the late Mr. Hill were made. It is an open stop, usually of wood, and of small scale, the block of the 16-feet CCC generally measuring only $5\frac{1}{2}$ inches by 7 inches. It forms the "Pedal bass" to the Gamba and other string-toned Manual stops. Its intonation is very crisp and pungent, and is in close imitation of the bowing on a large string instrument; hence its name Violone (Double Bass).

1319. In the organ at Cologne Cathedral the 16 feet Violone pipe measures as much as 12 inches across the mouth, and is, from its great scale, called "Contra Violone." When heard from the choir of the cathedral, its tone is very like a fine Pedal Diapason combined with a soft 16-feet Reed of equal quality and accurate intonation.

XX.

SPECIFICATION FOR AN ORGAN OF EIGHTY-SEVEN STOPS, FOUR MANUALS, AND PEDAL.

Great Organ, 22 Stops.

1. Sub-Bourdon to the tenor c key . . . 32 feet tone.
2. Double Open Diapason . . . . . 16 feet.
3. Bourdon . . . . . 16 feet tone.
4. Open Diapason . . 8 feet.
5. Open Diapason . . 8 feet.
6. Gamba . . . . . 8 feet.
7. Stopped Diapason, metal . . . . . 8 feet tone.
8. Clarabella to tenor c . 8 feet.
9. Quint . . . . . 5⅓ feet.
10. Principal . . . . 4 feet.
11. Principal . . . . 4 feet.
12. Flute . . . . . 4 feet.
13. Twelfth . . . . . 2⅔ feet.
14. Fifteenth . . . . . 2 feet.
15. Piccolo . . . . . 2 feet.
16. Full Mixture, III ranks 2 feet.
17. Sharp Mixture, V ranks 2 feet.
18. Cornet, II, III, and IV ranks.
19. Double Trumpet . . 16 feet.
20. Posaune . . . . . 8 feet.
21. Trumpet . . . . . 8 feet.
22. Clarion . . . . . 4 feet.

Swell Organ, 20 Stops.

23. Bourdon . . . . 16 feet tone.
24. Open Diapason . . 8 feet.
25. Gamba . . . . . 8 feet.
26. Echo Dulciana . . 8 feet.
27. Rohr Gedact . . . 8 feet tone.
28. Voix Celeste . . . 8 feet.
29. Principal . . . . 4 feet.
30. Gambette . . . . 4 feet.
31. Flute . . . . . 4 feet.
32. Twelfth . . . . . 2⅔ feet.
33. Fifteenth . . . . 2 feet.
34. Octave Flute . . . 2 feet.
35. Mixture, V ranks . . 2 feet.
36. Echo Dulciana Cornet, V ranks . . . 4 feet.
37. Double Bassoon . . 16 feet.
38. Hautboy . . . . . 8 feet.
39. Trumpet . . . . . 8 feet.
40. Horn . . . . . 8 feet.
41. Clarion . . . . . 4 feet.
42. Vox Humana . . . 8 feet tone.

Choir Organ, 15 Stops.

43. Lieblich Bourdon . . 16 feet tone.
44. Open Diapason . . 8 feet.
45. Lieblich Gedact . . 8 feet tone.
46. Flauto Traverso . . 8 feet tone.
47. Dulciana . . . . 8 feet.
48. Keraulophon . . . 8 feet.
49. Spitzflöte . . . . 4 feet.
50. Dulcet . . . . . 4 feet.
51. Flute . . . . . 4 feet tone.
52. Twelfth . . . . . 2⅔ feet.
53. Gemshorn . . . . 2 feet.
54. Flageolet . . . . 2 feet.
55. Mixture, IV ranks . 1⅓ foot.
56. Corno di Bassetto . 8 feet tone.
57. Bassoon, throughout 8 feet.

Solo Organ, 12 Stops.

58. Bourdon . . . . . 16 feet tone.
59. Violin Diapason . . 8 feet.
60. Flute Harmonic . . 8 feet.
61. Violino . . . . . 4 feet.
62. Flute Octaviant . . 4 feet.
63. Piccolo Harmonic . 2 feet.
64. Contra Fagotto . . 16 feet.
65. Clarinet . . . . . 8 feet tone.
66. Hautboy . . . . . 8 feet.
67. Hautboy Clarion . . 4 feet.
68. Tuba . . . . . 8 feet.
69. Tuba Clarion . . . 4 feet.

Pedal Organ, 18 Stops.

70. Double Open Bass, wood . . . . 32 feet.
71. Double Open Bass . 32 feet tone.
72. Open Bass, wood . 16 feet.
73. Great Bass, wood . 16 feet.
74. Violone . . . . 16 feet.
75. Stopped Bass. . . 16 feet tone.
76. Great Quint Bass . $10\frac{2}{3}$ feet tone.
77. Principal Bass, metal 8 feet.
78. Violoncello, wood . 8 feet.
79. Flute Bass . . . . 8 feet tone.
80. Twelfth Bass. . . . $5\frac{1}{3}$ feet.
81. Fifteenth Bass . . . 4 feet.
82. Mixture, VI ranks . $3\frac{1}{3}$ feet.
83. Contra Posaune . . 32 feet.
84. Posaune . . . . . 16 feet.
85. Bassoon . . . . . 16 feet.
86. Trumpet . . . . . 8 feet.
87. Clarion. . . . . 4 feet.

Accessory Stops, Movements, &c.

1. Coupler Swell to Great.
2. Choir to Great.
3. Solo to Great.
4. Great to Pedal.
5. Swell to Pedal.
6. Choir to Pedal.
7. Solo to Pedal.
8. Tremulant to Swell.
9. Pneumatic Lever attachment.
10, 11. Pedal Ventils.
12, 13, 14, 15. Four Composition Pedals to Great Organ, acting on Pedal Organ in proportion.
16, 17, 18. Three Ditto to Swell.
19. Piano Pedal.

Compass.

Manual, CC to C^4 in altissimo, 61 notes. | Pedal, CCC to tenor f, 30 notes.

1320. The length of the slides in large Pedal organs is so great, and the weight of the superincumbent pipe-work so considerable, that the slides frequently can only be set in motion by the exercise of great force. This motive power is sometimes provided in the shape of a pneumatic action. But this is not always sure in its operation, and is, moreover, liable to extra resistance from atmospheric causes. Walcker, of Ludwigsburg, puts every stop of his large Pedal organs on a separate sound-board, furnished with mushroom valves; and the stops are controlled by ventils, which can then be worked by a simple tracker. This plan has so many conveniences to recommend it, that Messrs. Hill and Sons are adopting something of the same kind in principle for the Yarmouth organ they are now rebuilding, and for the Great organ for Melbourne Town Hall.

1321. It will be seen that the German custom of attaching the word "Bass" to the Pedal stops of double size to the Manual stops of like kind has been followed in all the preceding specifications. This has been done, not only because it is the most simple system of nomenclature that has yet been devised, but also because it is the only system that appears to be likely to clear away the confusion that has so long existed in England as to the only correct manner of naming and classifying the Pedal stops. It has frequently been the case that the 8-feet Pedal stops have been classed as Diapasons instead of as Octaves; whereas the Pedal stops are, in nearly every instance, twice the length of the similarly labelled Manual stops. Exceptions to this rule, however, are presented by the Trumpet and Clarion, which are 8 and 4 feet stops respectively, whether placed on the Manual or Pedal.

1322. There are several excellent stops in German organs that are not at present made in England, for which reason their names have not been included in the foregoing specifications. They will, however, be readily traced in the plans of foreign organs that will now be given in the form of an Appendix. An examination of these schemes and a comparison of different specifications, comprising the same number of stops, with the view of ascertaining their points of difference, will be found not only a very interesting, but also a very instructive employment.